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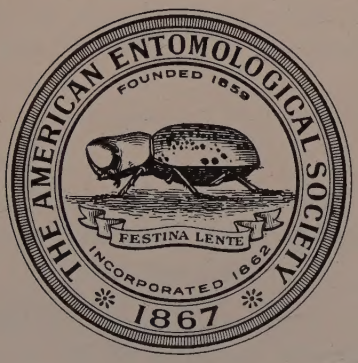

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LIST OF PAPERS

BLAISDELL (FRANK E., JR.)

Miscellaneous Studies in the Coleoptera. No. 6. (Melyridae and Tenebrionidae) 129

(Issued September 25, 1942)

BROMLEY (S. W.)

Madagascar Robber-flies, with Descriptions of New Species (Diptera: Asilidae) 11

(Issued April 16, 1942)

CRESSON (EZRA T., JR.)

Synopses of North American Ephydridae (Diptera). I. The Subfamily Psilopinae, with Descriptions of New Species 101

(Issued September 24, 1942)

DALMAT (HERBERT T.)

New Genus and Species of Cuterebridae from Costa Rica and Other Taxonomic Notes (Diptera) 23

(Issued June 8, 1942)

HEBARD (MORGAN)

The Dermaptera and Orthopterous Families Blattidae, Mantidae and Phasmidae of Texas 239

(Issued February 8, 1943)

REHN (JAMES A. G.)

The Locusts of the South American Generic Group Tristirae (Orthoptera: Acrididae: Cyrtacanthacridinae). 31

(Issued August 3, 1942)

On the Locust Genus Psoloessa (Orthoptera: Acrididae: Acridinae) 167

(Issued December 9, 1942)

RICHARDS (A. GLENN, JR.)
A Revision of the Species of Gabara of Eastern United States (Lepidoptera: Phalaenidae) 1
(Issued April 6, 1942)

ROBERTS (H. RADCLYFFE)
Two Subspecies of Melanoplus differentialis and Related New Species from Mexico, with Discussion of their Variations (Orthoptera: Acrididae: Cyrtacanthacridinae) 151
(Issued November 9, 1942)

TRANSACTIONS

OF THE

AMERICAN ENTOMOLOGICAL SOCIETY

VOLUME LXVIII

A REVISION OF THE SPECIES OF GABARA OF EASTERN UNITED STATES

(LEPIDOPTERA: PHALAENIDAE)

BY A. GLENN RICHARDS, JR.

Zoological Laboratory, University of Pennsylvania

(Plate I)

Widespread confusion has existed in the identification of species of this group. The reasons are the large intraspecific variation, particularly the common similarity of variants of one species to similar variants of the other species, and the identification from color and pattern alone. The only satisfactory criteria for separation, so far as I can discover, are in the male genitalia. Because of the universal confusion all published records are ignored and reference made only to specimens identified from slides of the male genitalia by myself—over 110 slides of male genitalia of these three species have been examined. Females are relatively uncommon in collections and usually have males associated with them.

The ten specific and one aberrational name proposed by various authors are currently listed as nine distinct species in two or three genera. The present paper groups three genera into one, and the ten specific names into three species (two of which have eastern and mid-western races).

TRANS. AMER. ENT. SOC., LXVIII.

Issued April 6, 1942 1094.20

The three generic names concerned have also had a confusing history. The oldest of these names is *Gabara* Walker. This was unrecognized for many years until finally placed as a prior name for *Eucalyptra* Morrison in the 1917 Checklist. There is nothing in the original description to belie this placement, no other form known to me that might fit, and a colored figure of the genotype agrees well with *E. nivealis* Smith. Yet in 1926, Hampson separated these leaving *Eucalyptra* for the entire genus as we know it in this country, and placing *Gabara* as a prior name for *Capis* Grote, *Oxycilla* Grote and *Aggustiana* Schaus. The association of *Capis* and *Oxycilla* makes this undecipherable as these two have little in common and have since been placed in different subfamilies on a basis of both tympanal and genital anatomy.[1]

The other two generic names are *Eucalyptra* Morrison and *Cilla* Grote. Concerning *Eucalyptra* there is no question as the original description is well drawn and the type species well known even though the type specimen is now lost. The placement of *Cilla* here is new. The original description and the description and figures given by Hampson differ from small pale-colored specimens of *Gabara* in only one detail, namely the strength of the vein M_2 (vein 5) of the hind wing. This is a somewhat variable character and one readily mistaken. A specimen in the Barnes collection compared with the type of *C. distema* by Dr. McDunnough is a typical *Gabara* in all characters including male genitalia.

I would like to express thanks to the numerous individuals and institutions which assisted in the loan of material. Examinations cover the collections of the Academy of Natural Sciences of Philadelphia, Cornell University, American Museum of Natural History, U. S. National Museum, and the private collections of Dr. Alexander B. Klots, Dr. A. E. Brower, Dr. F. M. Jones, Mr. F. Lemmer, Mr. C. P. Kimball and odd specimens from diverse sources. Most of the J. B. Smith material in this group came from the dealer George Franck who retained part of the series. Later Mr. Franck sold his collections to Ward's Natural Science Establishment, and in 1931 I purchased the remainder of this material from which most of Smith's types were obtained. The present location of specimens is given by abbreviations in brackets in the paragraphs on distribution.

[1] Richards, Ent. Amer., XIII, pp. 13 and 25, 1933.

GABARA Walker

Gabara Walker, Cat. Br. Mus., Lepid., xxxv, (Suppl. 5), p. 1740. 1866. (*G. subnivosella,* sole sp.) Barnes & McDunnough, Checklist N. A. Lepid., p. 88. 1917. [Placed as prior name for *Eucalyptra.*] Hampson, Lepid. Phal. N. Gen. & Sp. Noct., p. 261. 1926. [Separated from *Eucalyptra.*] McDunnough, Checklist Macrolepid., p. 125. 1938. [= *Eucalyptra.*]

Eucalyptra Morrison, Ann. Lyc. Nat. Hist. N. Y., xi, p. 103–104. 1875. [*E. bipuncta,* sole sp.] Grote, Bull. Geol. Surv., iv, p. 179. 1878. [Syn. of *Scolecocampa* Gn.] Grote, Bull. Brook. Ent. Soc., iii, p. 38. 1880. [Syn. of *Scolecocampa* Gn.] Smith, Bull. Brook. Ent. Soc., v, p. 6. 1882. [Separated in key.] Smith, Can. Ent., xv, pp. 229–230. 1883. [Compared with *Scolecocampa.*] Smith, Cat. Noct., U. S. Nat'l Mus., Bull. 44, p. 191. 1893. [Listed.] Dyar, List N. A. Lepid., U. S. Nat'l Mus., Bull. 52, p. 205. 1902. [Listed.] Smith, Trans. Amer. Ent. Soc., xxix, pp. 217–222. 1903. [Diagnosis, key, etc.] Barnes & McDunnough, Checklist N. A. Lepid., p. 88. 1917. [Syn. of *Gabara.*] Hampson, Lepid. Phal. N. Gen. & Sp. Noct., p. 243. 1926. [Separated from *Gabara.*] McDunnough, Checklist Macrolepid., p. 125. 1938. [Syn. of *Gabara.*]

Cilla Grote, N. Amer. Ent., i, p. 100. 1880. [*C. distema,* sole sp.] Hampson, Cat. Lepid. Phal., ix, p. 312. fig. 134. 1912. [Redescribed.] Also listed separately in all checklists since 1880.

The following description is drawn wholly from the three species occurring in eastern United States and would have to be modified somewhat if the southwestern and neotropical species are retained as congeneric.

Moths of moderate size (18–32 mm.) and rather lightly built.[2] Proboscis weak but functional. Palpi obliquely ascending, projecting about twice the length of the head; first joint small, second joint long and heavily scaled with strong fringe (almost a tuft) on upper side near tip, third joint about one-third as long as second but appearing shorter because its basal half is hidden in the heavy vestiture of the second segment. Male antennae with long cilia. Front smooth and rounded out; frontal tuft one-half length of head, pointed, triangular, its upper surface continuous with top of head. Thorax with mixed vestiture but mostly scales, smooth (no tufts). Fore legs with swollen coxae, and tibiae only slightly more than half as long as femora, densely scaled. Mid and hind legs with fringe of hair on femora; tibiae densely scaled and somewhat swollen. Abdomen smoothly scaled. Venation: areole present, with veins R_2, R_{3+4} and R_5 arising from it; in hind wing R_s and M_1 connate from upper end of cell, M_3 and Cu_1 connate from lower end of cell, and M_2 arising close to M_3 and paralleling it.

The tympanal structures are quite variable though all along one pattern. Alula normal, hood weak or lost, nodular sclerite weak or lost, pocket I

[2] See Holland, The Moth Book, pl. 29, fig. 9.

shallow, II reaching IV, III when present small and in the mouth of II, IV moderately large and tending to be complete anteriorly.[3]

Male genitalia: Uncus normal and pointed; tegumen and vinculum normal; juxta large; anellus spinulated; valves single, ending in a recurved point, and with one or two costal prongs (these prongs probably do not represent a clasper complex as they are associated with the costal margin, and the muscle of the valve[4] attaches to the bare ridge of the sacculus); penis swollen basally, vesica with one or more large spines in addition to a spinose plate.

Female genitalia: Segments VIII and IX short; VIII complete ventrally and fused with opening of ductus bursae, its apophyses short. Bursa with complete or incomplete ring of microtrichiae plus extremely minute microtrichiae anterior to this band. Ductus bursae moderately sclerotized with strong supporting sclerite at opening where fused with sclerite of segment VIII. Ductus seminalis arising from bursa near ductus bursae. The female genitalia do not furnish good characters for specific identification.

Revised listing of species:

Gabara Walker
= *Eucalyptra* Morrison
= *Cilla* Grote
1. *G. pulverosalis* (Walker)
= *minorata* (Smith)
2. *G. subnivosella* Walker
= *nivealis* (Smith)
race *bipuncta* (Morrison)
3. *G. distema* (Grote)
= *strigata* (Smith)
= *depunctata* (Strand)
race *humeralis* (Smith)
= *umbonata* (Smith)
= *apicalis* (Smith)

Key to Species Based on Male Genitalia

1. Distal of two costal prongs long, curved, and almost reaching end of valve.....*G. pulverosalis*
Distal of two costal prongs shorter than basal prong or absent.....2
2. Vesica with one large spine (usually also one small spine)..*G. subnivosella*
Vesica with two large spines.....*G. distema*

Gabara pulverosalis (Walker)

Scopula (?) pulverosalis Walker, Cat. Br. Mus., XXXIV, (suppl. 4), p. 1478. 1865. [Type: 1 ♂, without data; in British Museum.]

Eucalyptra minorata Smith, Trans. Amer. Ent. Soc., XXIX, p. 221. 1903. [Type: 1 ♂, Hastings, Fla. Oct. 4 (Kearfott); in Rutgers Univ. collection.]

[3] Richards, Ent. Amer. (n. s.), XIII, figs. 41–43. 1933.

[4] This is muscle No. 5 of Forbes treatment. It attaches to the base of functional claspers when such are present. See *Ann. Ent. Soc. Amer.*, XXXII, pp. 1–10. 1939.

Specimens are almost always dark sooty with the t. p. line distinct, but some dwarfs are light, almost white. None has been seen with a longitudinal streak. This is a relatively rare species. After one is familiar with the variation of all the species, specimens of *pulverosalis* can usually but not always be separated from variants of the other two species by the sooty color.

The name *G. pulverosalis* is applied in the sense of specimens so labeled in the Barnes collection (U. S. National Museum) on the basis of comparison with a colored drawing of the type. This determination is probably correct. Five males agreeing closely with the type of *E. minorata* place this name as based on slightly atypical, dwarfish specimens of *G. pulverosalis*.

Expanse, 18 to 30 mm., usually 24 to 28 mm.

Male genitalia (figs. 15–16). Well characterized by costal prongs of valve. The vesica usually has one large and one moderate spine but may have two large spines or only one spine. (17 slides examined.)

Female genitalia. Not separable from other species. (1 slide examined.)

Distribution.—NEW JERSEY: Lakehurst, July, [ANSP, USNM, AEB, FL, AGR]. Vineland, [AMNH]. VIRGINIA: Skyland, July, [USNM]. TENNESSEE: Monteagle, June, [ANSP, USNM]. NORTH CAROLINA: Tryon, July, [AMNH]. Southern Pines, [USNM]. FLORIDA: Hastings, Oct., [Rutgers, USNM]. Lagrange, Sept., [ANSP]. Eustis, Oct., [USNM, AEB]. Panacea, Aug., [USNM]. Venice, May, [USNM]. St. Petersburg, Apr. & Sept., [USNM].

Gabara subnivosella Walker

Gabara subnivosella Walker, Cat. Br. Mus., Lepid., XXXV, (Suppl. 5), p. 1740. 1886. [Type: 1 ♂, U. S. (Doubleday); in British Buseum.]

Eucalyptra nivealis Smith, Trans. Amer. Ent. Soc., XXIX, p. 220. 1903. [Type: ♂, Iowa City, Iowa, June 23, 1898 (Wickham); in Rutgers Univ. Coll.]

This is the Mississippi valley race, differing from eastern specimens in being almost or quite immaculate and silvery white. One specimen shows slight streaking along the veins, others are immaculate and even without the discal spots. Seemingly rare.

Walker's name is placed on the basis of a colored drawing of the type in the Barnes Collection. As such the placement will continue questionable until the genitalia of the type are examined, but I have seen such silvery-white, immaculate specimens only from the middle west. There is in the American Museum of Natural History a topotypical specimen of *G. nivealis*. This matches

Smith's type and has the same genitalia as other western specimens. This specimen is used to place the name. I have also examined the male genitalia of Smith's cotype (=paratype) of *nivealis;* this specimen is the same species but I question the locality data it bears. This cotype bears two labels: one handwritten "Hastings," the other typed "Florida." There is no date and no collector's name. These labels are the same as on specimens I have from Mr. G. Franck and as such are certainly open to question. I have seen specimens such as these only from Illinois, Iowa, Kansas and Nebraska, and have not seen any authentic specimens of *subnivosella* or its race *bipuncta* from Florida or even from the coastal plain of the southern Atlantic states.

Expanse, 24 to 28 mm.

Male genitalia (figs. 11–12). Distal of the two costal prongs not longer than the proximal prong, sometimes distal prong absent (all degrees of reduction). Vesica with one large spine and usually a second small spine. Genitalic variations not related to variations in maculation or locality; all degrees of intermediates between figures 11 and 12 present. (6 slides examined.)

Female genitalia (figs. 13–14). Not separable from other species. (1 slide examined.)

Distribution.—ILLINOIS: U.S.N.M. Acc. 20395. IOWA: Sioux City, June, [USNM]. Iowa City, June, [Rutgers, AMNH]. KANSAS: Douglas County, July, [AEB], Riley County, June, [CU]. NEBRASKA: Omaha, June, [USNM].

Gabara subnivosella race **bipuncta** (Morrison)

Eucalyptra bipuncta Morrison, Ann. Lyc. Nat. Hist. N. Y., XI, pp. 103–104. 1875. [Type: 1 ♂, Belmont, Mass., Aug. 17, 1874; type now lost.]

This is the commonest form in collections, and also the most widespread and most variable. Specimens vary from light and nearly immaculate (lightly powdered with darker scales) to very dark lead-grey, either with or without the two discal spots, with or without a dark t. p. line, and with or without a longitudinal streak. I can match the wing-pattern and colors of the majority of the specimens seen of the other two species from my long series of this race.

The Morrison type is now lost (cannot be found in the Tepper collection). However, it was certainly studied by Grote [5] and

[5] Bull. Brook. Ent. Soc., III, p. 38. 1880.

probably also by Smith.[6] The original description is good, and the type locality is well north of the range of either of the other two species. And also, *G. pulverosalis* which reaches central New Jersey never resembles this particular color form (although some specimens of *G. bipuncta* do resemble *G. pulverosalis*). All Massachusetts specimens, including one from Newton Highlands (approximately 5 miles from Belmont), are of this race.

Expanse, 24 to 32 mm., usually 25 to 28 mm.

Male genitalia (figs. 11–12). As in *G. subnivosella.* All degrees of variation between figures 11 and 12. Genitalic variations not related to variations in maculation or locality. (43 slides examined.)

Female genitalia (figs. 13–14). As in *G. subnivosella.* All degrees of variation between figures 13 and 14. (4 slides examined.)

Distribution.—MAINE: Biddeford, July, [USNM]. MASSACHUSETTS: Belmont, Aug., [lost type]. Newton Highlands, [USNM]. Boston, [USNM]. Nantuckett, Aug., [CPK, AEB, AGR, ANSP]. Martha's Vineyard, July–Aug., [ANSP, FMJ]. Forest Hills, July, [AEB]. Woods Hole, Aug., [CU]. Worchester, July, [CU, USNM, AGR]. Westborough, June, [CU]. Jamesville, July, [CU]. CONNECTICUT–RHODE ISLAND: Killingly Pond, July, [ANSP, ABK, AGR]. NEW YORK: Bear Mountain, [AGR]. Armonk, July, [USNM]. Bedford, July, [AGR]. Katonah [AMNH]. Moshala, [AMNH]; NEW YORK: Long Island: Orient, July, [CU]. Baldwin, July, [ANSP, USNM, AGR]. Hewlett Bay Park, July, [USNM, AGR]. NEW JERSEY: Lakewood, July, [AMNH]. Lakehurst, June–July, [ANSP, USNM, AMNH, AEB, FL, AGR]. Ramsey, July, [AMNH]. PENNSYLVANIA: Scranton, [AEB]. VIRGINIA: Fairfax, July, [USNM]. TENNESSEE: Monteagle, July, [USNM, AGR]. NORTH CAROLINA: Tryon, July–Aug., [USNM]. SOUTH CAROLINA: Clemson College, June, [USNM].

The habitat of this species is recorded in the literature as the coastal salt marshes. The species is most common in the upper part (brackish and fresh water part) of the salt marshes and may be taken there (at least on Long Island) in large numbers. But it is not seen on the lower, truly saline portions of the marshes, and it may be taken at swamps and marshes well removed from the seashore and from salt water. Obviously it must breed on marshland grasses, either in the upper part of tidal marshes or in inland marshes. Examination of long series revealed no differences between coastal and inland specimens.

[6] Cat. Noct., U. S. Nat'l Mus., Bull. 44, p. 191. 1893.

Gabara distema (Grote)

Cilla distema Grote, N. Amer. Ent., I, p. 100. 1880. Hampson, Cat. Lepid. Phal., IX, p. 312, fig. 134. 1912. [Type: Texas; in British Museum.]

Cilla distema ab. *depunctata* Strand, Arch. Natg., (A), LXXXI, p. 165. 1916. [Type: Texas; in British Museum.]

Eucalyptra strigata Smith, Jour. N. Y. Ent. Soc., X, pp. 45–46. 1902. [Type: Hackley, Texas (May & Sept.); in Rutgers Univ. Collection.]

This is the Texas race of the common southern species, and with its eastern race (*G. humeralis*) it replaces *G. subnivosella* and *bipuncta* in the Gulf states. The older name refers to the light form which is rare in collections. Most of these have two black spots in the cell; those that lack these dots have unfortunately been named ab. *depunctata* by Strand. The common and more widespread Texas form (*strigata*) is larger and has a conspicuous dark longitudinal streak the length of the wing.[7] This longitudinal streak is not distinctive as it occurs also in *G. subnivosella bipuncta* and uncommonly in *G. distema humeralis*. The Texas race is only questionably distinct from the eastern race; *G. distema* has a whiter background and the longitudinal streak in available material is either absent or completely developed.[8]

Determination of *G. distema* is based on Hampson's description and figure, on the locality, and on a compared with type specimen in the Barnes Collection (including male genitalia slide). The type of ab. *depunctata* came from the type series of *G. distema,* and Grote and Hampson were probably correct in associating the specimens with and without spots. The determination of *G. strigata* is based on 2 ♂ and 4 ♀ from Mr. G. Franck and presumably from the same lot that furnished Smith's types.

Expanse: light form 18 to 22 mm., form with streak 22 to 25 mm.

Male genitalia (figs. 1–10). Characterized by distal of two costal prongs being small, and vesica with two large subequal spines in addition to the large, spinose, sclerotized plate. Genitalic variations not related to variation in maculation. (7 slides examined.)

Female genitalia. Not separable from other species. (5 slides examined.)

Distribution.—TEXAS: Hackley, May & Sept., [Rutgers, USNM]. Devers, June, [CU]. Kingsville, [CU]. Smith Point, Aug., [USNM]. Harris Co., Aug., [USNM]. Black Jack Springs, [USNM].[9]

[7] Colored figure in Holland's Moth Book, pl. 29, fig. 9.

[8] A few of the specimens of typical *humeralis* received from Mr. G. Franck are labeled "Tex." or "Harris Co." These are probably mislabeled; at least none of the subsequent authentic Texas material is of this type.

[9] Light color form (*distema*) from only last two localities; form with streak (*strigata*) from all except the last named locality.

Gabara distema race **humeralis** (Smith)

Eucalyptra humeralis Smith, Trans. Amer. Ent. Soc., xxix, pp. 220–221. 1903. [Type: Hastings, Florida (Apr., June, Sept., Oct.); in Rutgers Univ. Coll.]

Eucalyptra umbonata Smith, Trans. Amer. Ent. Soc., xxix, p. 221. 1903. [Type: Hastings, Florida (Apr. & June); in Rutgers Univ. Coll.]

Eucalyptra apicalis Smith, Trans. Amer. Ent. Soc., xxix, p. 221. 1903. [Type: Hastings, Florida (June, Sept., Oct.); in Rutgers Univ. Coll.]

This is the common and variable form of the southeastern states. It is inclined to be yellowish but varies from nearly white to dark grey, the discal spots may be present or absent, a longitudinal streak may be more or less developed (usually absent), and the t. p. line is weak or absent. Only a few of the many Florida specimens seen match the Texas *G. distema; humeralis* tends to be a darker yellowish-brown.

The color form described as *G. humeralis* is the common form (and the name has page priority); *G. umbonata* is simply the dark nearly melanic variant; *G. apicalis* the whitish variant. There are similar (and additional) color forms in the other species—fortunately nameless.

From Mr. Franck's collections I have part of the material from which the types of these species were picked. A cotype (= paratype) male of each from the Barnes collection has also been examined genitalically.

Expanse: 20 to 28 mm., usually 22 to 24 mm.

Male genitalia (figs. 1–10). As in *G. distema.* (35 slides examined.)

Female genitalia. As in *G. distema.* (3 slides examined.)

Distribution.—North Carolina: Southern Pines, Sept., [USNM, AGR]. Tryon, July, [USNM]. Tennessee: Monteagle, Aug., [ANSP, AGR]. Georgia: Clarke County, Aug., [USNM]. Catoosa County, Aug., [ANSP]. Valdosta, July, [AMNH]. Alabama: Cowarts, Aug., [AMNH]. Dothan, July, [AMNH]. Florida: Hastings, Apr., June, Sept., Oct., [Rutgers, ANSP, USNM, AMNH, AGR]. Altamont, Oct., [USNM]. St. Petersburg, Aug., [USNM]. Fort Meade, [USNM]. Arkansas: No further locality, May, [USNM].

Explanation of Figures

Plate I

Fig. 1.—*Gabara distema humeralis* (Sm.). Male genitalia of striped specimen from Athens, Georgia, Aug. 12, 1928.

Fig. 2.—*Gabara distema* (Grt.). Striped specimen from Smith Point, Texas, Aug. 10–22.

Fig. 3.—*Gabara distema humeralis* (Sm.). Specimen from Southern Pines, N. Carolina. Sept. 13, 1937.

Fig. 4.—*Gabara distema humeralis* (Sm.). Genitalia similar to those of cotype (= paratype) of *humeralis*. Specimen from Hastings, Florida.

Fig. 5.—*Gabara distema humeralis* (Sm.). Specimen from Hastings, Florida.

Fig. 6.—*Gabara distema* (Grt.). Specimen (but not genitalia) compared with type. Specimen from Black Jack Springs, Texas.

Fig. 7.—*Gabara distema humeralis* (Sm.). Specimen from Hastings, Florida.

Fig. 8.—*Gabara distema humeralis* (Sm.). Penis drawn below. Specimen from Dothan, Alabama, July 31, 1916.

Fig. 9.—*Gabara distema humeralis* (Sm.). Cotype of *apicalis* Sm. Specimen from Hastings, Florida.

Fig. 10.—*Gabara distema humeralis* (Sm.). Cotype of *umbonata* Sm. Specimen from Hastings, Florida.

Fig. 11.—*Gabara subnivosella* Wlk. Penis drawn below. Specimen from Omaha, Nebraska, June 25.

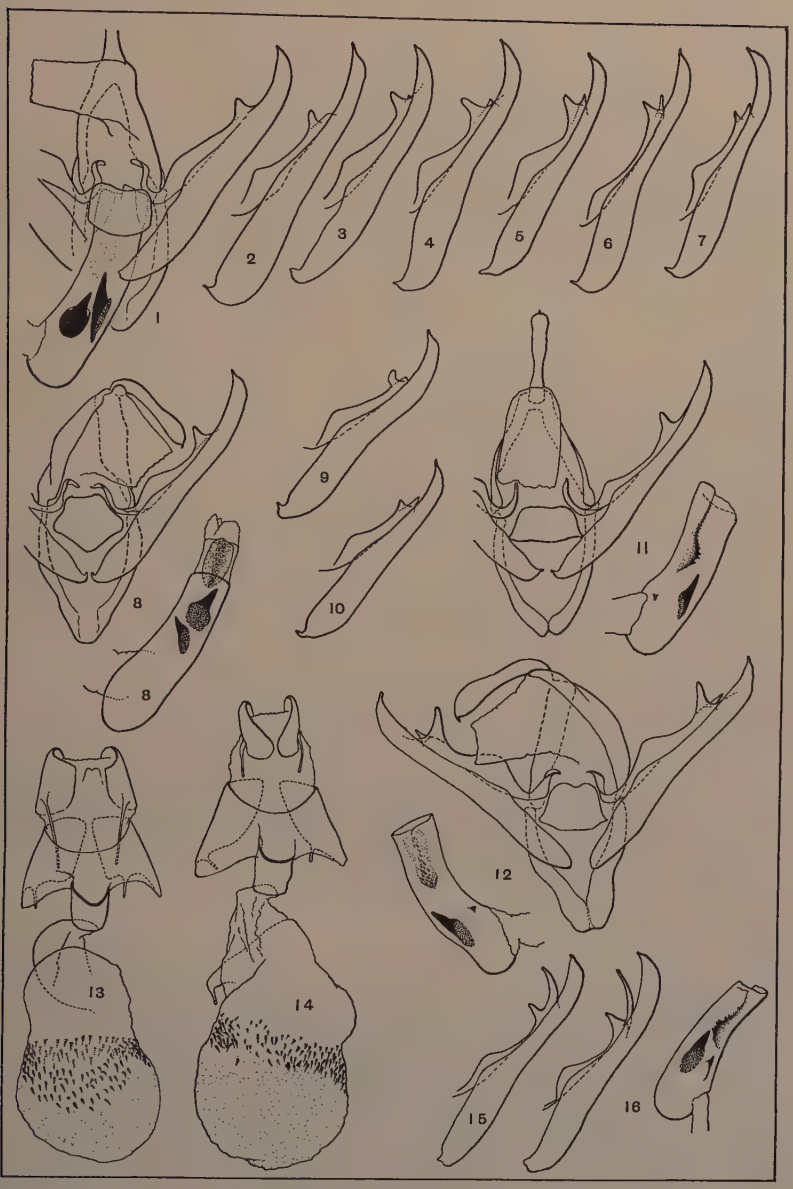
Fig. 12.—*Gabara subnivosella bipuncta* (Morr.). Penis drawn below. Specimen from Killingly Pond, Connecticut-Rhode Island, July 26, 1930.

Fig. 13.—*Gabara subnivosella* Wlk. The spinose band extends completely around the bursa. Specimen from Omaha, Nebraska, June 30.

Fig. 14.—*Gabara subnivosella bipuncta* (Morr.). The spinose band extends only approximately two-thirds the distance around the bursa. Specimen from Killingly Pond, Connecticut-Rhode Island. July 26, 1930.

Fig. 15.—*Gabara pulverosalis* (Wlk.). Specimen from Monteagle, Tennessee, June 23, 1930.

Fig. 16.—*Gabara pulverosalis* (Wlk.). Penis drawn alongside. Specimen from Lakehurst, New Jersey, July.



RICHARDS—GABARA

MADAGASCAR ROBBER FLIES WITH DESCRIPTIONS OF NEW SPECIES

(DIPTERA: ASILIDAE)

BY S. W. BROMLEY

Bartlett Tree Research Laboratories, Stamford, Connecticut

(Text-figures)

Included in a collection of Madagascar Diptera, received by The Academy of Natural Sciences of Philadelphia [1] were a considerable number of Asilidae.[2] The present paper is a study of this material, consisting of 326 specimens, representing ~~130~~ 130 species of which fourteen are here described as new. The types, except where otherwise mentioned, are in the collection of The Academy of Natural Sciences of Philadelphia. The writer is indebted to Mr. E. T. Cresson, Jr. of the Academy for the opportunity of studying these specimens.

The material was collected at various times from January to May by Charles Lamberton, but no definite dates are given. The present collection was collected in the Oriental Forest at Moramanga in the District of Tananarive, and at Fanovana in the District of Tamatave.

LEPTOGASTERINAE

Leptogaster lambertoni new species (Text-fig. 1.)

No previous species of *Leptogaster* have been recorded from Madagascar. The present species differs from all others known

[1] The Academy is indebted to Mr. Charles M. B. Cadwalader, its President, for the presentation of this interesting representation of Madagascar insects of several orders.

[2] The author had previously published (Trans. Amer. Ent. Soc., LIII, pp. 201–207, 1927) on the genus *Microstylum*, from the forest around Tananarive, and lists all the species of that genus recorded from the Island, with key to the species known to him.

Issued April 16, 1942 1095.25

to the writer in that the 4th and 5th tergites of the abdomen bear a bifid knob on their anterior portions which bear a peculiar bunching of pale brown and blackish hairs.

Total length, 17 mm. A dark brown species, the genitalia conspicuous with several thread-like processes, the hind femora with two pale bands on the distal enlargement, the hind tibiae long, slender, uniformly dark brown, the hind tarsi paler.

Male. Antennae and proboscis dark brown, face and frons nearly black, mystax whitish. Mesonotum polished, the median line and two large side spots indistinct blackish, the rest dark brown. Pleura dark brown, scutellum with disk blackish brown, the rim pale brown. Wings hyaline. Halteres brownish, the stalks paler. Legs pale brown, middle femora and tibiae dark brown, hind femora dark brown with two pale bands at the distal enlargement, hind tibiae dark brown, hind tarsi pale brown, two prominent black bristles on the inner apex of the hind tibiae, hind tarsi with black bristles; claws long, slender, black, a little under twice the length of the last segment. Abdomen dark brown, the sides and incisures somewhat paler; the fourth and fifth tergites with a peculiar bunching of pale brown and blackish hairs emanating from a bifid knob on their anterior portions. Genitalia enlarged, brownish with several filiform processes as indicated in figure 1.

Type.—Male; Oriental Forest, Fanovana, District of Tamatave, Madagascar; [A.N.S.P., no. 6633].

This species is named in honor of Prof. Charles Lamberton, Academie Malgache, Tananarive, Madagascar.

Leptogaster madagascarensis new species

Smaller than *L. lambertoni.* The hind femora are not banded as in the latter species and the abdomen lacks the bifid knobs on the fourth and fifth tergites.

Total length, 13 mm. A blackish brown species, the hind legs dark blackish brown, the hind tibiae enlarged towards the apices so that the latter are nearly three times the diameter of the bases of the hind tibiae.

Female. Antenna and proboscis blackish. Mesonotum polished black, pleura dark brown. Wings hyaline, irridescent. First two pairs of legs dark brown, the tibiae and tarsi slightly paler. Posterior legs long, slender, blackish brown with black bristles. The posterior tibiae enlarged at the tip. Halteres and abdomen blackish brown. The dark color of the thorax and abdomen of this species is probably accentuated by grease, which has obscured whatever pollinose condition that might have been present. The color and conformation of the posterior extremities are quite different from *L. lambertoni* as indicated above.

Type.—Female; Oriental Forest, Fanovana, District of Tamatave, Madagascar; [A.N.S.P., no. 6634].

Leptogaster cressoni[3] new species

Differs from both *L. lambertoni* and *L. madagascarensis* in being a pale testaceous in ground color instead of dark or blackish brown.

Total length, 14 mm. A pale testaceous species with a pale brownish band on the distal portions of the hind femora.

Female. Antennae black, proboscis pale yellowish-brown. Thorax pale yellowish brown. Legs pale yellowish brown, claws black, the hind femora with a pale brownish band on the distal enlargement. Wings hyaline, iridescent. Knobs of halteres black, stalks pale yellowish-brown. Abdomen dark yellowish brown, sides and incisures lighter.

Type.—Female; Oriental Forest, Fanovana, District of Tamatave, Madagascar; [A.N.S.P., no. 6635].

DASYPOGONINAE

Damalis clavigerus[4] new species

The present is the first species of *Damalis* recorded from Madagascar. It differs from *D. longipennis* Loew from Caffraria in having the abdomen clavate among other distinguishing characters.

Total length, 11 to 11.5 mm. A slender, elongate, black, grayish pollinose species with abdomen clavate, similar to that found in the neotropical *Laphriine* genus *Rhopalogaster.*

Male. Face white pruinose; mystax, beard whitish with faint yellowish fringe, basal segment of antenna with black bristles, arista very slender, slightly more than four times the length of basal portion; mesonotum grayish-white pollinose with deep brown median line and two lateral spots on either side almost confluent. Pleura shining grayish white pollinose. Scutellum and hypopleura also whitish pollinose. Wings hyaline; halteres, yellowish. Legs blackish, bases of femora and basal three-fourth of tibiae obscure reddish. Abdomen black, about four times as long as length of mesonotum, segments 2 and 3 constricted, the third abruptly widening, the abdomen broadest at the junction of fourth and fifth tergites. Dorsum of abdomen, except at junctures where the integument is shining black as is also first, second, and base of third segments, sordid gray pollinose. Genitalia inconspicuous, brownish.

Female. Similar; the abdomen slightly stouter.

Type.—Male; Oriental Forest, Fanovana, District of Tamatave, Madagascar; [A.N.S.P., no. 6636].

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[3] This species I have named in honor of Mr. E. T. Cresson, Jr., one of the outstanding North American Dipterists.

[4] The specific name *clavigerus* has been adopted for this species because of the characteristic club-shaped abdomen.

Allotype.—Female; with same data as type.

Paratypes.—5 females; with same data as type.

One paratype has been placed in the collection of the author.

Holcocephala lambertoni new species

Total length, 8 mm. A rather robust brownish species bearing a remarkable superficial resemblance to the American *H. abdominalis* Say but the thorax is relatively higher and broader and the abdomen is more brownish.

Female. Face brownish, vestiture pale brown, vertex pale brown pollinose, occiput gray pollinose, post-genal hairs white. Mesonotum pale golden brown pollinose with a broad dark brown central stripe and two side spots. Scutellum and pleura pale yellowish brown pollinose, the pleura darker than the scutellum with the scanty vestiture pale yellowish white. Legs yellowish brown with golden brown hairs, femora dark brown above, the hind tarsi, the apex of the hind tibiae and the distal two segments of the anterior and middle tarsi blackish brown. Claws black, pulvilli brown. Wings brown, the basal halves darkest. Halteres yellowish brown with the knobs blackish brown in the dorsal center. Abdomen uniformly brownish.

Type.—Female; Oriental Forest, Fanovava, District of Tamatave, Madagascar; [A.N.S.P., no. 6637].

This is the first species of *Holcocephala* to be recorded from Madagascar.

Stichopogon punctum Loew

1851. *Stichopogon punctum* Loew, Prog. Realsch. Meseritz., 1851, p. 15.

Fanovana, 2 ♂.

Microstylum luciferoides new species

This species bears a superficial resemblance to *Microstylum lucifer* Bromley.[5]

Total length, 23 to 25 mm. A black species with yellow bands on the third and fourth abdominal tergites, the basal half of the wings orange yellow, and four front tibiae and tarsi yellowish, the hind tarsi testaceous. Related to *M. lucifer* Bromley but distinguished therefrom by the yellowish tarsi and tibiae of the first four legs which are black in *M. lucifer.* The reddish lines on the mesonotum of *M. lucifer* are missing in the present species.

Male. Head with its vestiture completely black, face brownish pollinose, thorax and its vestiture completely black. Wings with basal half yellowish, apical half black. Halteres yellow. Femora and coxae deep black, legs with black hair and bristles; extreme tips of first four femora, tibiae, tarsi, pulvilli and bases of claws yellow. Hind tibiae blackish brown, their bases

[5] Bull. Brooklyn Ent. Soc., xxv, p. 285, 1930.

and articulations with the femora yellowish brown, hind tarsi yellowish brown. The middle tibiae on their inner apices bear a decided blunt chitinous prolongation. Abdomen black, the third and fourth tergites with a more or less obscure yellowish band. Genitalia blackish brown, with both black and yellowish brown hairs.

Type.—Male; Fanovana, District of Tamatave, Madagascar; [A.N.S.P., no. 6638].

Paratype.—1 ♂; with same data as type.

Microstylum griseum Bromley

1927. *Microstylum griseum,* Trans. Amer. Ent. Soc., LIII, p. 206.

Fanovana, 2 ♂.

Microstylum gigas (Wiedemann)

1821. *Dasypogon gigas* Wiedemann, Dipt. Exot., p. 216, pl. 3, fig. 7.

Northwest Madagascar, May, 1 ♂, 1 ♀.

Microstylum tananarivensis Bromley

1930. *Microstylum tananarivensis* Bromley, Bull. Brook. Ent. Soc., XXV, p. 286.

Fanovana, 5 ♂, 16 ♀. Moramanga, 4 ♀.

Microstylum cilipes Macquart

1838. *Microstylum cilipes* Macquart, Dipt. Exot., I, (2), p. 28, pl. 2, fig. 5.

Moramanga, 1 ♀.

Microstylum insigne Bromley

1927. *Microstylum insigne* Bromley, Trans. Amer. Ent. Soc., LIII, p. 206.

Fanovana, 13 ♂, 35 ♀.

LAPHRIINAE

Nusina aurea Bromley

1935. *Nusina aurea* Bromley, Rev. Zool. Bot. Africa, XXVI, p. 441.

Fanovana, 3 ♀.

Laphria macra Bigot

1859. *Laphria macra* Bigot, Ann. Soc. Ent. France, (3), VII, p. 415.

Fanovana, 3 ♂, 1 ♀.

Laphria nusoides Bromley

1930. *Laphria nusoides* Bromley, Bull. Brook. Ent. Soc., XXV, p. 287.

Fanovana, 29 ♂, 51 ♀. Moramanga, 4 ♂, 3 ♀.

Orthogonis[6] **madagascarensis** new species (Text-fig. 2.)

This is the first species of *Orthogonis* to be described from either the African or Madagascan areas. It differs from *O. scapularis* (Wied.) from the East Indies in its smaller size and in lacking bright colored hairs on the face and humeri.

Total length, 12 mm. A small blackish species with white pruinose face, white beard and scattered fine white hairs on mesonotum and pleura. The wings slightly smoky.

Female. Head black, proboscis massive and pointed. Palpi large elongate and thickly set with black bristles (Fig. 2). Hairs of face, postgenae and beard white. Bristles of mystax, palpi, antennae, occiput, the two occipitals, two long bristles below the antennae, black. Thorax black, with black bristles. Mesonotum with fine, short, scattered white hairs. Pleura and coxae with short scattered white hairs. Legs black with black bristles and white hairs. Wings slightly smoky, their bases paler. Abdomen black, the tergites punctulate.

Type.—Female; Oriental Forest, Fanovana, District of Tamatave, Madagascar; [A.N.S.P., no. 6639].

ASILINAE

Ommatius fanovana new species

Differs from *O. longiforceps* and *O. lambertoni* in having the wings hyaline instead of yellowish and in being decidedly smaller.

Total length, 9 to 11 mm. A small, black, grayish pollinose species with dark mesonotum, no pteropleural bristle, two fine scutellars, the legs yellowish, the hind tibiae with their distal halves blackish, the femora with their tips blackish.

Male. Face narrow, whitish pollinose. Two pairs of long black hairs below the antenna, but the lower shorter hairs of mystax whitish. Proboscis, palpi, antennae, and occellar tubercle blackish brown. Occiput grayish pollinose. Pleura and coxae gray pollinose with whitish hairs. Disc of mesonotum blackish brown, the posterior calli and the scutellum shining grayish pollinose. Scutellum with a pair of fine blackish marginal bristles. Wings hyaline, the tips slightly smoky. Halteres grayish yellow. Legs yellowish, junction of coxae and femora blackish, the fore coxae yellowish in ground color. Tips of femora above blackish, the hind femora above blackish on the distal quarter. Tibiae and metatarsi yellowish, the posterior tibiae with the distal half brownish, remaining segments of tarsi blackish but the hind metatarsi decidedly brownish. Hairs and bristles of legs blackish. Abdomen slender, blackish. The upper forceps of the male genitalia short, surpassed in length by two slender processes emanating from the central part of the hypopygium.

Female. Similar.

[6] The genus *Orthogonis* was first described from the Orient. There is one North American species, i.e. *Orthogonis* (*Laphria*) *stygia* (Bromley).

Type.—Male; Oriental Forest, District of Tamatave, Madagascar; [A.N.S.P., no. 6640].

Allotype.—Female; with same data as type.

Paratypes.—6 ♀; with same data as type.

Ommatius longiforceps new species (Text-fig. 3.)

The unusually long forceps of the male are the most important distinguishing feature.

Total length 13 to 17 mm. A blackish species with unusually long slender hypopygium, no pteropleural bristle, the scutellum with a pair of heavy upright black bristles, the wings smoky, the legs yellowish with blackish areas.

Male. Head blackish, vestiture blackish except lower part of mystax and beard where there are some whitish hairs. Thorax blackish, mesonotum with blackish hairs and bristles. Pleura and coxae with whitish hairs. Coxae all black, first four femora and tibiae yellowish, tips of all femora and tibiae blackish, all tarsi blackish. Distal half of hind femora blackish. Legs with black bristles, and mostly yellowish or whitish hairs. Wings slender, smoky. Halteres dark brown. Scutellum black (probably greased) with two black upright marginal bristles. Abdomen elongate, slender, black. The hypopygium long, slender, pointed, blackish about the length of segments 6, 7 and 8 together (Fig. 3).

Female. Similar; the abdomen, however, decidedly shorter than the wings.

Type.—Male; Oriental Forest, Fanovana, District of Tamatave, Madagascar; [A.N.S.P., no. 6641].

Allotype.—Female; with same data as for type.

Paratypes.—2 ♂, 1 ♀; with same data as for type.

There are two other females from the Oriental Forest, Moramanga, District of Tananarive.

Ommatius lambertoni new species

Differs from *O. longiforceps* in having a shining golden-brown spot on the humeri.

Total length, 15 to 19 mm. A blackish species with long smoky wings, a shining golden brown spot on the humeri, the legs mostly yellowish, pteropleural bristle absent, a pair of black scutellars.

Female. Face brown pollinose. Mystax whitish, ocellars two, black; beard whitish. Upper occipitals blackish, lower yellowish. Thorax blackish, humeri with a glistening golden brown spot. Pleura grayish pollinose, hypopleurals long, yellow. Legs yellowish, the extreme tips of the femora blackish, the hind tarsi somewhat darker than the others, the tips of the hind tibiae dark. The vestiture of the legs largely pale but bristles black. Scutellum grayish pollinose, with two black marginal bristles. Wings large, yel-

lowish, tips smoky. Knobs of halteres dark reddish brown. Abdomen long, slender but shorter than the wings, black.

Type.—Female; Oriental Forest, Fanovana, District of Tamatave, Madagascar; [A.N.S.P., no. 6642.]

Paratypes.—2 ♀; with same data as for type.

Ommatius terminalis Bromley

1936. *Ommatius terminalis* Bromley, Ann. Transv. Mus., XVIII, p. 129.

Fanovana, 2 ♂, 7 ♀.

Ommatius pulchripes Bigot

1859. *Ommatius pulchripes* Bigot, Ann. Soc. Ent. France, (3), VII, p. 419.

Fanovana, 14 ♂, 17 ♀. Moramanga, 2 ♂, 3 ♀.

Ommatius fallax Bigot

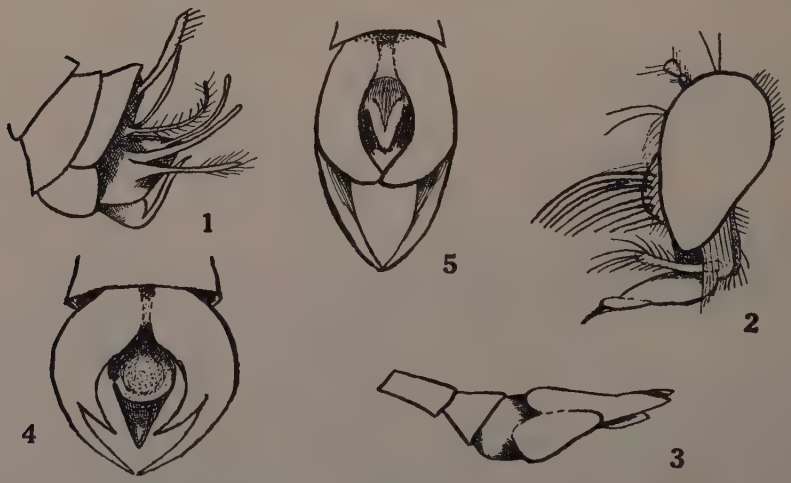
1875. *Ommatius fallax* Bigot, Ann. Soc. Ent. France, (5), v, p. 247.

Fanovana, 2 ♂, 3 ♀.

Ommatius macquarti Bezzi

1908. *Ommatius macquarti* Bezzi, Ann. Soc. Ent. Belg., LII, p. 379.

Fanovana, 2 ♂, 5 ♀.



Text-fig. 1.—*Leptogaster lambertoni* new species. Lateral aspect of male genitalia. Fig. 2.—*Orthogonis madagascarensis* new species. Profile of head of female. Fig. 3.—*Ommatius longiforceps* new species. Lateral aspect of male genitalia. Fig. 4.—*Senoprosopis fanovanensis* new species. Dorsal aspect of male genitalia. Fig. 5.—*Neomochtherus madagascarensis* new species. Dorsal aspect of male genitalia.

Senoprosopis fanovanensis new species (Text-fig. 4.)

The first record of the Oriental genus *Senoprosopis* to be reported from either Africa or Madagascar. Differs from *S. diardii* Macquart from India in having the genitalia shorter and more compact.

Total length, 19 to 20 mm. A yellowish species with the median mesonotal line bifid auteriorally, the lateral spots three on each side, all velvety black contrasting with the yellow pollenosity of this area. The genitalia pale brownish, legs and wings yellowish, the latter with darker tips.

Male. Proboscis and palpi brownish, antennae yellowish brown. Occellar tubercle and a spot on each of the upper occipital orbits brown. Occipital bristles brownish. Mystax composed of brownish and yellow hairs intermingled. Palpal hairs brownish, scanty hairs of beard white, face shining yellowish white pollinose. Coxae and legs yellowish, the latter with pale hairs and brown bristles. Above the meso- and meta- coxae is a bluish black spot, the rest of the pleura yellowish brown with yellowish white pollen and pale brownish hairs. Mesonotum yellow pollinose with the prominent median stripe black, bifid anteriorally, with the intervening space reddish. Side spots, three in number on each side, velvety black. Bristles of posterior portion of mesonotum black, the two scutellars black also. Disc of scutellum with two black bristles in addition to the marginal setae, otherwise pale yellowish pollinose. Wings yellowish, the apices grayish. Halteres pale brownish. Abdomen brownish, with pale hairs and bristles. Genitalia pale reddish brown with the upper forceps bifid, the hypopygium being slightly longer than the fifth segment (Fig. 4).

Female. Similar, the ovipositor shorter than the eighth segment which is broad and shining.

Type.—Male; Oriental Forest, Fanovana, District of Tamatave, Madagascar; [A.N.S.P., no. 6643].

Allotype.—Female; with same data as for type.

Paratypes.—3 ♂, 2 ♀; with same data as for type.

Neomochtherus madagascarensis new species (Text-fig. 5.)

The first species of the genus to be reported from Madagascar. Somewhat similar in appearance to the Egyptian *N. longitudinalis* Loew but differs in being much paler in color and in having the lower prong of the upper forceps of the male genitalia projecting half a length beyond.

Total length 13.5 mm. A slender pale brownish species, the upper forceps of the genitalia bifid, the legs pale brownish, pteropleural bristle present.

Male. Face whitish pollinose. Mystax yellowish with a few brown bristles above. Proboscis, palpi and antennae dark brown (only two basal segments of the latter present); beard whitish, occipitals blackish. Thorax brownish pollinose, mesonotum with dark brown median stripe. Pleura and scutellum grayish brown pollinose. Hairs and bristles of mesonotum black, a pair of dark brown scutellars. Coxae grayish pollinose, with whitish hairs. Legs yellowish brown, the femora dark brown above, the hind femora blackish above. Tips of tibiae blackish, the hind tibiae largely blackish, tips of tarsal segments blackish, hairs of legs white, bristles black. Wings brownish, subhyaline. Halteres pale reddish brown. Abdomen slender, brownish pollinose, the bristles before the incisures pale brownish. Genitalia dark brown slightly shorter than segments 6 plus 7 (Fig. 5).

Type.—Male; Oriental Forest, Fanovana, District of Tamatave, Madagascar; [A.N.S.P., no. 6644].

Promachus hobbyi[7] new species

Total length, 19 mm. Very similar to *P. aurifacies* Hobby but distinguished by the anterior tarsi being densely clothed above with silvery hairs, and the hairs of the beard and of the front coxae gray instead of golden.

Male. Face yellowish pollinose, vestiture blackish except beard and lower hairs of mystax which are yellowish white. Mesonotum yellowish pollinose with a median stripe and two lateral spots on each side blackish. Scutellum yellowish gray pollinose, with several black bristles on or near the margin; hairs of disc yellowish. Pleura yellowish brown pollinose, vestiture yellowish. Coxae grayish yellow pollinose with pale hairs. Femora and tarsi blackish, tibiae yellowish, the tips of the posterior four blackish, the fore tarsi with dense silvery hair above. Wings pale brown, subhyaline, the marginal, submarginal and first posterior cells with dark brown shadows. Halteres pale yellowish brown. Abdomen slender, blackish, sides brown pollinose with pale hairs, dorseum of tergites with blackish hairs. Genitalia small, blackish, shorter than seventh segment.

Type.—Male; Oriental Forest, Fanovana, District of Tamatave, Madagascar; [A.N.S.P., no. 6645].

Promachus madagascarensis new species

Differs from *Promachus parvus* Bromley which is about the same size in having the legs entirely black, not reddish.

Total length, 16 mm. A small, slender black species with black legs, the pollen on the mesonotum yellowish brown, the wings pale smoky with darker tips.

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[7] I take pleasure in naming this species in honor of Dr. B. M. Hobby of Oxford University, England, who has done some admirable work on Madagascan Asilidae.

Male. Only two basal segments of antennae present, these are black with black bristles. Face pale yellowish brown pollinose. Beard pale fulvous. Occipitals, hairs and bristles of vertex and face, most of the mystax and bristles of palpi black. A few hairs of lower mystax pale yellowish brown. Mesonotum with deep black median line and two large lateral black spots one each side, elsewhere the mesonotum is pale golden brown pollinose. Scutellum pale grayish yellow pollinose with black bristles and pale yellowish hairs. Wings pale brown, subhyaline, the costal, the marginal, and submarginal cells with large blackish shadows. Halteres pale yellowish brown. Legs black, with black bristles and fulvous hairs. Genitalia black, slender, about the length of sixth segment.

Type.—Male; Oriental Forest, Fanovana, District of Tamatave, Madagascar; [A.N.S.P., no. 6646].

Promachus lemur Bromley

1930. *Promachus lemur* Bromley, Bull. Brook. Ent. Soc., xxv, p. 288.

Fanovana, 2 ♂, 2 ♀.

Promachus aurifacies Hobby

1933. *Promachus aurifacies* Hobby, Entom. Monthly Mag., lxix, p. 194.

Fanovana, 5 ♂, 13 ♀. Moramanga, 2 ♀.

Lecania atrimaculatus (Hobby)

1934. *Asilus atrimaculatus* Hobby, Entom. Monthly Mag., lxx, p. 15.

Fanovana, 10 ♂, 21 ♀.

NEW GENUS AND SPECIES OF CUTEREBRIDAE (DIPTERA) FROM COSTA RICA AND OTHER TAXONOMIC NOTES

HERBERT T. DALMAT

New York City

(Plate II)

Species of Cuterebridae are both scarce in collections and relatively unknown insofar as the specific hosts and biology are concerned. Completely satisfactory systematic concepts for the group have not yet been worked out. Considering only the Cuterebrini and Pseudogametini, it is commonly held that the members of the former tribe normally parasitize only rodents and lagomorphs, while the members of the latter either actually infest mammals other than these, or are suspected of doing so. However, host records are too meager to validate such a distinction between the tribes. The tribal characters of the Pseudomagetini are shown herein to fit well within the range of the respective characters of the Cuterebrini and it is proposed that Pseudogametini be eliminated and that the genera formerly included in it be referred to Cuterebrini. Also in this paper, one genus is placed in synonymy and one new genus and a single new species included in it are described from a specimen in the collection of the Academy of Natural Sciences of Philadelphia.[1]

[1] The author wishes to thank Dr. Joseph C. Bequaert for bringing the described specimen to his attention, Mr. Ezra T. Cresson, Jr. for making the specimen available, and Mr. James A. G. Rehn for his information concerning the type locality.

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Descriptions of the New Genus and Species

MONTEMYIA new genus

Montemyia is most closely related to *Oricuterebra* Bau [2] (Cuterebrini Townsend [3]) from which it can be distinguished by the following characters: (a) The facial profile flat rather than strongly concave, (b) the aristae with cilia on the ventral side as well as on the dorsal, (c) the facio-oral profile arcuate to weakly angular rather than strongly angular and protruding, (d) the facial depression subcircular instead of heart-shaped. *Montemyia* also differs from *Oricuterebra* in having the facial depression brown pollinose instead of gray, the head mainly black-haired instead of with several yellow or gold hairs, the pleural pile black above (mesopleura entirely black pilose) and yellow beneath rather than yellow with a few black tufts, the abdomen without metallic luster and dark lateral bands, and the abdominal spiracles red rather than black. Both *Montemyia* and *Oricuterebra* possess in common several characters used by Townsend to differentiate his tribe Pseudomagetini, among which are the elongated and moderately sloped front, deep facial depression, bulging eyes, and approximated antennae.

Heavy-bodied. Head twice as broad as high; front elongated, moderately sloped; eyes bulging. Frontal profile arcuate; facio-oral profile weakly angular; facial profile flat. Vertical bristles not differentiated. Hairs on head mainly black, pollen brown to black. Prevertex [4] extended three-fifths way to lunula. Epistoma narrow at dorsal end, widening considerably toward the oral margin. Proboscis reduced to stout stump; palpi absent. Facial depression subcircular, tapered somewhat toward ventral end, without a carina. Antennae narrowly separated, third segment about one and one-half times as long as first and second together. Arista laterally compressed, widened for one-half the length and gradually tapered distally, ciliate along dorsal surface and with a few hairs near the middle of the ventral surface. Mesonotum mostly with dark pollen and pile. Mesoscutum over twice as wide as long. Propleura pilose; pleura black pilose above and yellow below. Abdomen much wider than thorax; seen from above, the fourth abdominal

[2] Ueber das Genus *Cuterebra* Clark; (Diptera, Oestridae); Einteilung desselben in sechs Untergattungen; Beschreibung neuer species und Aufstellung einer Bestimmungstabelle der mittel- und südamerikanischen Arten. *Konowia,* x, pp. 197–240. Wien. 1931.

[3] Manual of Myiology, II. Itaquaquecetuba, São Paulo, Brasil. 1935.

[4] The tapered area anterior to apical ocellus, extended toward the lunula, without hairs or bristles. This has arms bordering the ocellar triangle that sometimes reach the occiput.

segment strongly tapering. Ground color of abdomen mainly reddish yellow, no dark lateral bands; pile predominately yellow and rust colored, pollen yellow. Abdominal spiracles red. All tarsi widened and flattened. Opening of wing cell R_3 only slightly wider than that of R_5; stigma situated beyond midlength of wing; radio-medial crossvein far inside tip of subcosta; medial crossvein rather close to cubitulus, the latter rounded.

GENOTYPE: *Montemyia bureni* new species.

MONTEMYIA BURENI new species

Length, 20.2 mm.; wings, 16.6 mm. Head capsule at widest point, 7.2 mm.; distance between eyes at vertex, 2.1 mm. (Ratio 3.4 to 1.) Distance between eyes at vertex thirteen and one-half times distance between two posterior ocelli. Ocellar triangle small. Base of triangle, .55 mm.; arms of triangle, .3 mm. (Ratio 1.8 to 1.) Prevertex 1.4 mm. long with narrow arms extending to occiput.

Antennae and aristae (one broken) dark brown, aristae ciliate on dorsal surface and with a few short hairs on ventral surface about one-half way from base. Third segment of antennae one and one-half times length of first two taken together. Facial depression deep; base of depression and dorsal surface of antennae light brown pollinose. Hairs on first two antennal segments black. Eyes bulging and strongly convex. Head when viewed from above protruding forward, the ratio of breadth to length, 1.8 to 1. Buccae and lower part of parafacials dark brown to black pollinose, a large dark brown shining callus between eye and buccal cavity. Another large callus on each side of head between eye and dorsal half of facial ridge, the lower half of callus almost entirely glabrous, a few black hairs near ventral border, the upper half pitted and with black hairs. Upper part of parafrontals thinly dark brown pollinose. Frontal vitta velvety black pollinose. Hairs on vitta, parafrontals, and parafacials black; hairs on buccae mainly black, those on extreme ventral margin yellow and longer than others on head.

Mesonotum dark brown to black pollinose, clothed with short black pile. Humeri invested with black hairs; each postalar callus with both yellow and black hairs longer than others on dorsum and forming a cluster with the long yellow hairs above wing insertion. Triangular gray pollinose area on each side of longitudinal midline of scutum, the base of each triangle coinciding with transverse suture. Scutum one and one-tenth times length of prescutum, two and three-tenths times wider than long. Scutellum colored as mesonotum, clothed with black hairs, a few yellow ones on posterior margin. Pleura light brown pollinose. Mesopleura clothed with black pile only slightly longer than that on mesonotum. Upper parts of propleura, pteropleura, and sternopleura black pilose, the lower parts yellow pilose. Yellow pile on prosternum and between legs. Legs reddish brown, clothed with black bristly hairs. Both yellow and black hairs on tegulae.

Abdomen subtriangular when viewed from above. Ground color reddish yellow except on dorsum of first segment and near midline of dorsum of second segment where it is brownish black. Large triangular patch of rust-colored pile extending over dorsal surface of second through fourth tergites, following contour of abdomen, bordered on all sides by yellow pile which tapers off toward end of fourth tergite. Yellow pile also extending to ventral surface, investing sternites. All yellow hair on abdomen longer than rust-colored, areas clothed with it being yellow pollinose. Several black hairs near midline of second tergite and some interspersed with rust-colored pile on third tergite. Fifth segment and genitalic sclerites invested with rust-colored pile. Abdominal spiracles red.

HOLOTYPE.—Male; Monte Redondo, Costa Rica (9°58′ North Latitude, 84°2′ West Longitude); altitude approximately 4000 feet; January, 1903; (C. F. Underwood); [Academy of Natural Sciences of Philadelphia, no. 6647].

Named in honor of William F. Buren, a keen observer and a faithful recorder of the facts.

TAXONOMIC NOTES

An examination of Townsend's descriptions of Cuterebrini and Pseudogametini [8] show that almost every character of the Pseudogametini (made up of the genera *Alouattamyia* Townsend, *Pseudogametes* Bischof, and *Xylocopodes* Townsend) fits within the range of the same character of the Cuterebrini and many of the features are identical in both tribes. The most important of these characters as given by Townsend are listed in the following table:

Character	Cuterebrini	Pseudogametini
Head width	¼ to ½ wider than high	Little to considerably wider than high
Frontal profile	Strongly arcuate to flat or even dished, well over to rather less than facial profile in length, gently to strongly sloped	Flat and about as long as facial
Facio-oral profile	Usually arcuate. Angular in *Oricuterebra*	Not arcuate
Callosities	On parafrontalia, parafacialia and cheeks usually	On parafacialia and parafrontalia
Front	Wide in both sexes	Wide
Clypeus	Subcircular to nearly twice as long as wide.	Ovate to subcircular
Facial carina	Well developed to absent	Absent or feebly indicated

Character	Cuterebrini	Pseudogametini
Antennae	Narrowly to very widely separated	Rather narrowly to considerably or well separated
Aristae	Plumose, bare, or pectinate	Plumose to the tip or pectinate
Cheeks	$\frac{2}{3}$ to over eye length	$\frac{2}{3}$ to nearly eye length
Vibrissae	None	Not differentiated from other hairs on vibrissal areas
Proboscis	Reduced to stout stump, palpi absent	Aborted, rostrum recessive, haustellum nearly as long as third antennal joint, labellum small, palpi absent
Legs	Stout and short to more elongate and slender. Tarsi widened or not widened	Moderately long and not very stout, tarsi not widened
Thoracic macrochaetae	None	Absent or vestigeal, at most postsuturals and postacrostichals recognizable
Wings	Stigma beyond midlength of wing. Prestigma long. Cubitulus usually rounded but at times angular and with short stump	Stigma long. Cubitulus more or less angular and with wrinkle but no stump

The only difference the author found to be somewhat constant when he examined representative genera of both tribes was a variation in the wing venation of *Xylocopodes* (*Alouattamyia* had the usual Cuterebrine type; *Pseudogametes* was not seen). All specimens of this genus had the subcosta terminating closer to the base of the wing, making the stigma longer than on Cuterebrine species, and the cubitulus was usually angular and without a stump. However, a few specimens were found that did have the stump, a character sometimes encountered in Cuterebrine wings. But even in the Cuterebrini, *Guerinioestrus* Townsend displayed atypical venation and slight variations were found amongst the wings of individuals within single species. At best, the differences in venation are only of generic value.

In separating the Pseudogametini from the Cuterebrini, the ciliation of the arista has been used as an important character. In examining approximately 350 specimens, it was found that the number and position of the hairs on the arista may vary within a genus. The typical condition for the North American Cuterebrini

is one in which the cilia line the dorsal surface and are present only distally on the ventral. Specimens of *Cuterebra cuniculi* Clark were found with the arista ciliate above and with hairs below both on proximal and distal ends but absent between. Some representatives of *Atrypoderma* Townsend showed this condition and others were found with the ventral cilia present only on the proximal end. A gradation within the two tribes is found, therefore, from the bare condition in *Rogenhofera* Brauer and *Gucrinioestrus* Townsend (both in Cuterebrini) to the plumose condition in *Xylocopodes* Townsend and *Pseudogametes* Bischof (both in Pseudogametini).

Certainly there is no set of characters, or single character, that distinguishes the Pseudogametini from the Cuterebrini and the genera placed in the former tribe obviously should be referred to the Cuterebrini.

Alouattamyia baeri (= *Cuterebra baeri* Shannon and Greene) was included in Pseudogametini by Townsend. The genus *Alouattamyia* Townsend (monotypic) in every way is identical with *Baucuterebra* Guimarães and Carrera [5] (= *Paracuterebra* Bau [6]). Examination of the type specimens proved that the propleura of *Alouattamyia* are pilose and not bare as originally characterized.[7] The shape of the head, facio-oral and frontal profiles, pectinate antennae, lack of facial carina, color and pilosity of all parts of the body, flattened and widened male front tarsi, and wing venation are the same for both so-called genera. The larvae of *A. baeri* are very similar to those of *Metacuterebra* Bau and the sawtooth-edged spines clothing them are also found on puparia of *Oricuterebra*. If the immature stages of *Baucuterebra* were known, they would probably be of the same type. One, therefore, cannot separate *Alouattamyia* and *Baucuterebra*. Since *Alouattamyia* was erected to include *baeri* before *Baucuterebra* was proposed, the latter must be eliminated and the species *schroederi* Enderlein, *ornata* Bau, and *almeidai* Guimarães and Carrera, formerly included in it, then

[5] Contribuição ao conhecimento dos Cuterebrídeos do Brasil. Separata dos *Arquivos de Zoologia do Estado de São Paulo,* III, (1), pp. 1–12. São Paulo, Brasil. 1941.

[6] Versuch einer Teilung der Gattung *Cuterebra* (Diptera, olim Oestridae) in vier Untergattungen. *Centbl. Bakt., Parasit., u. Infek.,* LXVII, (2), pp. 542–544. Jena. 1929.

[7] New genera and species of American Oestromuscoid flies. *Rev. de Ent.,* I, (3), pp. 313–354. Rio de Janeiro. 1931.

belong in *Alouattamyia*. The definition of *Baucuterebra* (= *Paracuterebra*) well describes the surviving genus, *Alouattamyia* Townsend (= *Baucuterebra* Guimarães and Carrera = *Paracuterebra* Bau).

Up to the present time, *Xylocopodes* and *Pseudogametes* have been caught only in the southern half of the Brazilian plateau region at altitudes of about 2500 feet. Almost all males of *Xylocopodes semiatra* Wiedemann have been taken at rather high spots on tree trunks. This seems to indicate that the host is some arboreal mammal. *Baucuterebra baeri* has been taken from howling monkeys in British Guiana. The belief of most workers that species belonging in the Cuterebrini normally infest only rodents and lagomorphs may have been a factor in the placement of *Baucuterebra, Xylocopodes,* and *Pseudogametes* into a separate tribe.

Species representing two genera of Cuterebrini have been found to infest cats and dogs quite commonly in North America. Pet owners and veterinary doctors in the midwestern United States have told the writer that it is a common practice to extract maggots of these flies from subcutaneous "pockets" in cats and dogs during the summer. Many of these maggots have been reared successfully to adults. From this evidence, it seems that the statement of Townsend ([3], page 221) and others to the effect that myiasis in cats and dogs caused by Cuterebrine larvae is accidental, might not be correct. Specimens have also been taken from opposums, hogs, and asses, but the hosts of most species are still unknown. In the future, it may be found that many of the South American Cuterebrini normally infest mammals other than rodents and lagomorphs.

Explanation of Plate II

Dorsal aspect of *Montemyia bureni* new species. (× 2)

DALMAT—AMERICAN CUTEREBRIDAE

THE LOCUSTS OF THE SOUTH AMERICAN GENERIC GROUP TRISTIRAE

(ORTHOPTERA; ACRIDIDAE; CYRTACANTHACRIDINAE)

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(Plates III–IX, text-figures)

For many years certain very distinctive acridid genera described from Chile and Patagonia by Philippi, Walker and Saussure have remained but little known, not only in their details but in their broad relationships as well. Almost every one of the relatively few students who have examined material of these, differed from his predecessors in his concept of their proper subfamily association. Other genera subsequently described from the Straits of Magellan and Patagonia by Brunner von Wattenwyl and Brancsik were individually as distinctive, apparently as unrelated, and each as wrongly associated as were those of Philippi, Walker and Saussure. Most of these generic units presented aggregations of external features which collectively in no way suggested affinity, and a rigid following of often faulty subfamily criteria generally marooned these genera widely from one another.

The efforts of their describers and subsequent students to place these genera in various subfamilies as then defined, produced some rather startling associations. Brunner's genus *Tristira* was considered by him and others to be truxaline (Truxalinae = modern Acridinae); *Papipappus, Pappus* (= *Pappacris*) and *Phrynotettix* (not of Glover) were considered by Saussure, their author, to be members of the Oedipodinae, while *Bufonacris* of Walker was placed by Saussure in the Eremobiinae (= modern Batrachotetriginae), which was also considered the proper resting place for *Eremopachys* by Brancsik, its describer.

TRANS. AMER. ENT. SOC., LXVIII.

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While Chilean and Argentinean series of Acrididae long in the Academy's collections included representatives of certain of these poorly understood genera, it was not until undescribed relatives contained in recently acquired Peruvian Andean collections became available, that the essential unity of these strikingly different Peruvian, Chilean and Patagonian genera was apparent. These previously unknown Peruvian types, together with another similarly unrecognized one from Chile, show features which tie together a number of these longer-known, otherwise apparently isolated genera, and permit the assembly of them into a natural and very distinctive genera group, peculiar to southern and south-central Andean South America. In 1906 when discussing the genus *Tristira* of Brunner von Wattenwyl, one of the components, then considered to be truxaline, I suggested [1] that it was "probably worthy of separation as a group Tristiri." With a correction of this name to its proper form Tristirae, it can be used for the well-marked genera group which is the subject of the present study.

The Tristirae are apparently an endemic South American assemblage, doubtless of considerable antiquity, if inference can be drawn from the external morphological diversity. The group either is or very recently has been in active evolution. The distribution of its definitely ascertained members shows that the dawn of its evolutionary history antedated the uplift of the Andes, or geologically speaking was not more recent than the early Pliocene. It is quite probable that when this orogenesis was inaugurated the Tristirae were already well diversified, with the chief lines of their now evident differentiation fully established. This we are warranted in assuming from the comprehensiveness of the modifications of the external morphology which the existing forms exhibit.

The generic components now occurring in Patagonia and the region of the Straits of Magellan represent one extreme of the group, when the genera are linearly arranged in accordance with the varying degrees of modification of features which they exhibit, while the genera at the opposite extreme are central and south Chilean. The genera which fill the gap between these diverging poles, and thus connect broad, depressed toad-like forms with others having strongly compressed, elongate bodies, are in part central and south Chilean—these approaching more nearly the

[1] Proc. U. S. Nat. Mus., xxx, p. 383, (1906).

Patagonian and Magellanic extreme—and in part Peruvian—which curiously are nearer the Chilean extreme just mentioned. Clearly there have been faunal movements, of which these rather unusual distributional affinities are evidence, but all indications point to our knowledge of existing forms as far from complete, and until this is more comprehensive speculation as to lines of movement seems premature.

The marked divergence seen in the external features of extremes of the group, with the accompanied masking of underlying and often interdigitating features by these relatively profound modifications in general form, would lead one, on purely superficial comparison, to feel that not one but at least four quite different assemblages of genera were represented. Only by the careful checking of many less obvious features is the relationship of such apparently divergent genera as *Bufonacris* and *Papipappus* on one hand, and *Tropidostethus* and *Elysiacris* on the other, made evident, and the possession of material of sufficient genera representing intermediate steps was necessary to demonstrate the soundness of the conclusions here expressed.

The already described genera which are clearly components of the group Tristirae are: *Tropidostethus* Philippi,[2] *Bufonacris* Walker,[3] *Phrynotettix* Saussure [4] (not of Glover, 1872 [5]), *Pappus* Saussure [6] (not of Distant, 1884) (=*Pappacris* Uvarov [7]), *Papipappus* Saussure,[8] *Tristira* Brunner von Wattenwyl,[9] and *Eremo-*

[2] Zeitschr. Ges. Naturw., XXI, p. 245, (1863). Genotype (by original designation): *Batrachopus? bicarinatus* Philippi, from Valdivia, Chile.

[3] Catal. Derm. Salt. Coll. Brit. Mus., V, Suppl., p. 89, (1871). Genotype (by monotypy): *Bufonacris terrestris* Walker, from Straits of Magellan.

[4] Mém. Soc. Phys. Hist. Nat. Genève, XXVIII, no. 9 (Prodromus Oedipodiorum), pp. 47, 99, (1884). Genotype (by monotypy): *P. rana* Saussure, from Chile.

[5] Illustr. N. Amer. Orth., pl. 6, fig. 25, (1872). Genotype (by monotypy): *Phrynotettix verruculatus* Glover, from the Pecos River, Texas.

[6] Mém. Soc. Phys. Hist. Nat. Genève, XXVIII, no. 9 (Prodromus Oedipodiorum), pp. 48, 100, (1884). Genotype (by monotypy): *Pappus patagonus* Saussure.

[7] Ann. and Mag. Nat. Hist., (11) VI, p. 114, (1940). To replace *Pappus* Saussure (not of Distant).

[8] Mém. Soc. Phys. Hist. Nat. Genève, XXVIII, no. 9 (Prodromus Oedipodiorum), pp. 48, 101, (1884). Genotype (by monotypy): *Papipappus clarazianus* Saussure, from between the Rio Negro and the Rio Chubut (in err. Chubat), Patagonia.

[9] Comun. Mus. Nac. Buenos Aires, I, no. 7, p. 235, (1900). Genotype (by monotypy): *T. bergi* Brunner von Wattenwyl, from Filaret, Terra del Fuego, Argentina.

pachys Brancsik.[10] Certain species of the group which have been described were referred by their authors to other genera, as *Moluchacris cinerascens* (Philippi), which was originally called a *Batrachopus*[11] by its author, *Elysiacris angusticollis* (Blanchard), which was referred to *Tropinotus* by its original describer, and *Punacris peruviana* (Saussure), which was placed by that author in the genus to which he applied the preoccupied name *Phrynotettix*. Seven of the genera treated in the present paper, as well as five of the species, are here described as new. Thirteen genera are here definitely referred to the Tristirae, all but two of which have been examined.

It is very probable that this group also includes other known genera of which material is not available for examination, or the descriptions and figures of which are not conclusive. The Galapagan genus *Closteridea* Scudder[12] in many ways suggests the new genera *Incacris, Crites* and *Paracrites,* all from Peru, and while certain features given in the description are discordant, numerous others agree with known members of the Tristirae. Reexamination of the unique type of *Closteridea* will be necessary to ascertain whether it belongs here. The probable close relationship of *Closteridea* to *Tristira* was suggested by me over thirty-five years ago.[13] While the Mexican genus *Xyronotus* I. Bolívar,[14] now placed in the Pyrgomorphinae, differs in a number of respects from the Tristirae, in others it shows some agreement, and it is possible future study of that genus may show it to be an aberrant member of the present group.

Subfamily position.—While, as already shown, previously known genera here placed in the Tristirae were variously assigned by their describers to the Acridinae, the Oedipodinae or the Batrachotetriginae, it is now clearly evident the insects belong to a single genera group, which tentatively can be placed in the Cyrtacanthacridinae.

[10] Jahresh. Naturw. Vereines Trencsener Comit., XXIII–XXIV, p. 188, pl. III, figs. 3 a, b, c and d, (1901). Genotype (here designated) : *Eremopachys bergii* Brancsik.

[11] For a discussion of this generic name see a forthcoming paper by the present author.

[12] Bull. Mus. Comp. Zool., XXV, no. 1, p. 9, pl. I, figs. 4 & 5, (1893). Genotype (by monotypy) : *C. bauri* Scudder, from Chatham Island, Galapagos Archipelago.

[13] Proc. U. S. Nat. Mus., XXX, p. 383, (1906).

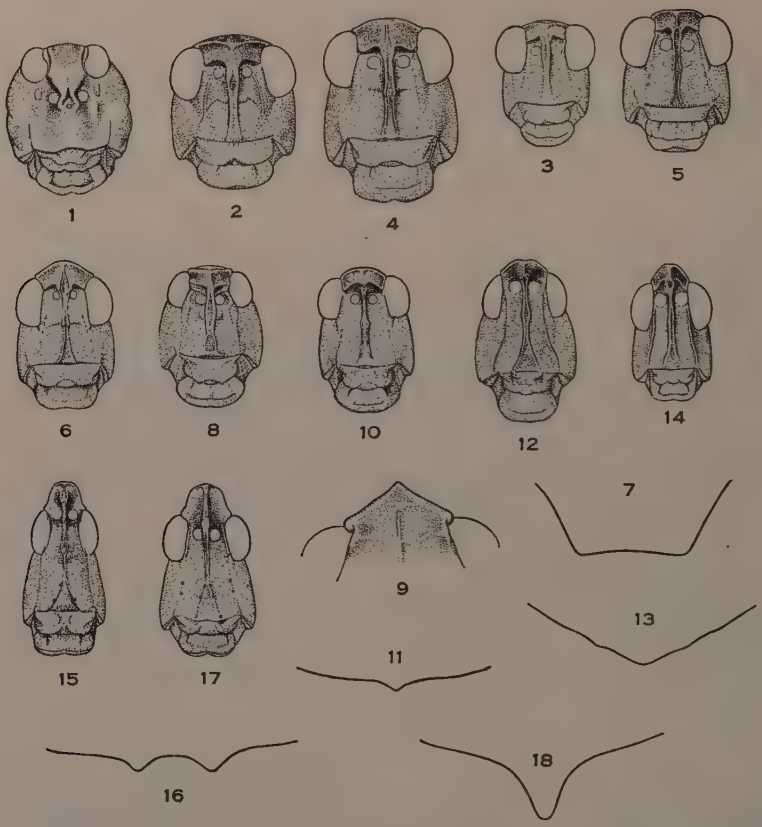
[14] Anales Soc. Españ. Hist. Nat., XIII, pp. 24, 442, 496, pl. II, figs. 12, 12a–c, (1884). Genotype (by monotypy) : *X. aztecus* I. Bolívar.

Whether that subfamily will have removed from it other units equal in size or value to the recently separated Romaleinae,[15] remains for the future to determine. Until a broad critical study has been made of the various genera groups left in, or, like the present one, added to the Cyrtacanthacridinae, it will hardly be possible to evaluate fully its features and limits. Certainly some of the genera groups contained in it as at present constituted are reasonably well defined, and in some cases are peculiar to definite zoögeographic areas. The removal of some of these to entities higher than genera groups also may be found necessary. The Group Tristirae is one of the latter, and until sufficiently comprehensive studies are made its placement is provisional. While clearly an isolated aggregation, standing well apart from any other, and the nearest relative to which among the various genera groups it seems inadvisable to suggest at this time, in a linear arrangement the Group Tristirae may be placed near the endemic Neotropical Vilernae, although this should not be taken as a considered expression of belief in their natural affinity.

My colleague Dr. H. Radclyffe Roberts, who has been doing exceptionally valuable comparative work on the phallic structures of male Acrididae, has at my request examined these parts in *Bufonacris, Papipappus, Moluchacris* and *Incacris,* and finds they are very similar in all four genera, and that on the basis of these structures these genera form a very distinctive and cohesive entity, in no way closely related to the numerous other genera of which he has studied the phallic development. In his opinion the similarity of the phallic features in the genera above mentioned indicates their fundamentally close relationship, while on the basis of the varied external morphology alone they might be considered to represent four quite different aggregations. I am hopeful that the future may increase the available series of more of the involved genera, so that Dr. Roberts may be able to examine the phallic structures of a larger number of the genera of the group.

General features.—The exceptional diversity of form encountered in the genera here placed in the Group Tristirae makes it exceedingly difficult to assign clearly-cut general features to the complex. Instead the evidence of relationship is most obvious in the overlapping of various characters, which thus tie the com-

[15] See Roberts, Proc. Acad. Nat. Sci. Phila., XCIII, pp. 217, 218, (1941).



Bufonacris terrestris Walker. Female. Gregory Bay, Straits of Magellan. Fig. 1.—Cephalic view of head (× 2½).

Moluchacris bufo new genus and species. Female (*type*). Talcahuano, Chile. Fig. 2.—Cephalic view of head (× 4). Male (*allotype*). Talcahuano, Chile. Fig. 3.—Cephalic view of head (× 4).

Moluchacris cinerascens (Philippi). Female. Angol, Chile. Fig. 4.—Cephalic view of head (× 4). Male. Angol, Chile. Fig. 5.—Cephalic view of head (× 4).

Peplacris recutita new genus and species. Female (*type*). Province of Valparaiso, Chile. Fig. 6.—Cephalic view of head (× 4). Fig. 7.—Outline of prosternum as seen in caudal aspect (greatly enlarged).

Punacris peruviana (Saussure). Female. Oroya, Peru. Fig. 8.—Cephalic view of head (× 4). Fig. 9.—Details of fastigium as seen in dorsal aspect (× 10).

Incacris phaenogaster new genus and species. Female (*type*). Conchamarca, Peru. Fig. 10.—Cephalic view of head (× 4). Fig. 11.—Outline of prosternum as seen in caudal aspect (greatly enlarged).

ponents together, rather than the possession in common of even a few sharply diagnostic combinations. The known extremes of the series, as linearly arranged, are so exceedingly dissimilar in their general habitus that it is only after considerable study that relationships become evident, while in their details they violate a number of long-supposed orthodox major divisional features of the Cyrtacanthacridinae. Among these may be mentioned the range in extent of fastigial delimitation, in the well defined or undefined lateral foveolae of the vertex,[16] the varied development of the prosternal production and the presence or absence of a distal spine on the external extensor margin of the caudal tibiae. However, I am aware of an almost equal amount of plasticity in the development of these same features in genera belonging to the cyrtacanthacridine genera group Euthymiae, which is a relatively old circumtropical assemblage, so this aspect of the Tristirae is less noteworthy, except to give further evidence of the lack of fundamental value in these long-revered criteria. The following resumé gives the more salient single features and combinations present in the known genera of the Tristirae.

Form ranging from broad, short and deplanate to compressed, elongate and deep. Antennae simple or ensiform, 8 to 20 articles. Fastigium ranging from deflexed and little evident to trigonal or rostrately produced. Lateral foveolae of vertex present or absent. Face in profile subvertical to markedly concave retreating. Frontal costa evident but variously developed, even lamellately unicarinate in part (*Elysiacris*). Pronotum broad, expanding caudad and strongly deplanate dorsad to strongly compressed, sharply tectate

Crites prestoni new genus and species. Female (*type*). Leonpampa, Peru. Fig. 12.—Cephalic view of head (× 3). Fig. 13.—Outline of prosternum as seen in caudal aspect (greatly enlarged).

Paracrites pichis new genus and species. Male (*type*). Pichis Trail, Peru. Fig. 14.—Cephalic view of head (× 4).

Elysiacris angusticollis (Blanchard). Female. Cerros de Nahuelbuta, Chile. Fig. 15.—Cephalic view of head (× 4). Fig. 16.—Outline of prosternum as seen in caudal aspect (greatly enlarged).

Tropidostethus bicarinatus (Philippi). Female. Rio Valdivia, Chile. Fig. 17.—Cephalic view of head (× 3). Fig. 18.—Outline of prosternum as seen in caudal aspect (greatly enlarged).

[16] I have used this terminology to indicate the lateral subfastigial pagina-like areas present directly dorsad of the insertion of the antennae. The areas were referred to by Saussure, when describing his genus *Phrynotettix*, as the "plagiae supra-antennales."

and deep, surface tuberculate, rugose or multicarinate, accessory postocular carinae on dorsum almost always traceable, often marked, complete or incomplete; metazona never longer, usually much shorter, than prozona; caudal margin of pronotal disk variously developed, often narrowly emarginate mesad, never produced. All forms apterous. No evident external auditory tympana present (true of all genera examined). Lateral surfaces of abdomen in males very definitely smoother than dorsum, often polished. Supra-anal plate in both sexes distinctly divided into two sections by a transverse suture.[17] Caudal tibiae with distal external spine present or absent. Tarsal claws equal, arolia present.

Key to the Genera of the Group Tristirae

1. Body broad, deplanate, never compressed. Head in profile lacking a definite fastigio-facial angle; surface of fastigium broadly rounding ventrad into that of frontal costa without a clearly defined transverse carinal rim. Antennae with 16 or more (usually more) articles. Surface texture rugose or rugulose and tuberculate, but never definitely multicarinate. (Head form very broad; genae very tumid; frontal costa broadly expanded about median ocellus.).....2

   Body ranging from relatively broad to strongly compressed. Head in profile with a definite fastigio-facial angle, surface of fastigium clearly cut off from frontal costa by a definite transverse carinal rim. Antennae with fewer than 16 articles.[18] Surface texture varied, sometimes longitudinally multicarinate.....3

2. Body exceptionally broad, strongly depressed, toad-like, greatest breadth across mesothorax, outline of thoracic dorsum and associated proximal abdominal tergite sublozenge-shaped. No delimiting borders in the usual position of the lateral foveolae of the vertex; frontal costa less definitely bordered dorsad of median ocellus and antennal bases. Antennae with 16 to 17 articles. (Straits of Magellan and Patagonia.)
   Bufonacris Walker

   Body moderately broad, depressed but much less so than in alternate category, hardly toad-like, breadth across mesothorax and metathorax subequal, lateral outlines of thoracic dorsum in part subparallel and elsewhere more rounded, hardly sublozenge-shaped. Low strumose borders outlining the usual position of the lateral foveolae of the vertex,

[17] I am not attempting to express the exact morphological homology of these two sections, and I prefer to consider both as parts of the supra-anal plate as understood taxonomically, the division being in exactly the same position as the median transverse sulcus or imbrication which is found in many acridid genera and especially a very large number of species of the Cyrtacanthacridinae.

[18] In counting the number of antennal articles care must be taken to include only primary divisions separating definite articles, and not to include the subsidiary and incomplete pseudosegmentation noticed in certain of the Tristirae genera. The inclusion of such subsidiary and incomplete divisions may lead to erroneous conclusions in using this key.

in part continued ventrad as lateral borders of frontal costa. Antennae with 20 articles. (Patagonia.).....*Papipappus* Saussure

3. Pronotum ascending caudad, or if not ascending caudad the caudal margin of pronotum is truncate, and the prozona of pronotum is mediolongitudinally sulcate instead of carinate. Head very broad; genae exceedingly tumid.[19] (Antennae with 9 to 13 articles.).....4

Pronotum not ascending caudad. Head narrower; genae much less tumid. (Face reclivent. Antennae with 8 to 16 articles.).....5

4. Face vertical. Antennae with 11 to 13 articles, distal one narrowly expanded, elliptico-clavate. Pronotum with caudal margin subarcuate; metazona subequal in length to prozona, former ascending caudad, making general pronotal outline subsellate in profile. Abdominal dorsum with five longitudinal series of cariniform tubercles. Ovipositor valves slender, acute. (Apical spine absent from external extensor margin of caudal tibiae.) (Patagonia.).....*Pappacris* Uvarov

Face reclivent. Antennae with 9 to 10 articles, distal one simple. Pronotum with caudal margin truncate; metazona much shorter than prozona, former not ascending caudad, pronotal outline not subsellate in profile. Abdominal dorsum without longitudinal series of tubercles. Ovipositor valves robust, broad, flattened dorsad. (Apical spine present on external extensor margin of caudal tibiae.) (Patagonia.) *Eremopachys* Brancsik

5. Antennal articles 14 to 15. Body never compressed, often markedly depressed.....6

Antennal articles 8 to 11. Body never markedly depressed (approached only in *Punacris*), generally quite definitely compressed.....8

6. Body relatively slender, subfusiform, not at all depressed. Antennae depressed, subensiform. No median carina present on fastigium and occiput. Prosternum having a transverse arcuate ridge. Supplementary carinae marked and complete on dorsum of thorax and abdomen (latter with five). (Straits of Magellan and Tierra del Fuego.) *Tristira* Brunner von Wattenwyl

Body stout, often depressed. Antennae in no way subensiform. Distinct median carina present on fastigium and occiput. Prosternum bearing a transverse truncate or subtruncate ridge. Any supplementary carinae present on dorsum of thorax and abdomen are incomplete and disjointed.....7

7. Fastigio-facial angle rounded in profile. Fastigium with transverse margins not sharply carinate. Facial line but moderately retreating. Lateral foveolae of vertex well defined, subvertical in position. Eyes flattened subcircular in basal outline. Lateral postocular carinae of pronotum strongly developed. Meso- and metanota longitudinally multirugoso-carinate. (Chile.).....*Moluchacris* new genus

[19] Features drawn entirely from descriptions, no material of these genera examined.

Fastigio-facial angle in profile definitely produced, subrostrate. Fastigium with transverse margins sharply carinate. Facial line strongly retreating. Lateral foveolae of vertex less definite, ventral in position, ventral margin subobsolete. Eyes definitely ovoid in basal outline. Lateral postocular carinae of pronotum weakly developed. Meso- and metanota rugulose, but not longitudinally multirugoso-carinate. (Chile.) *Peplacris* new genus

8. Body stout, subdepressed only in female. Supplementary carinae of dorsum of thorax and abdomen strongly marked throughout. Prosternum with a low transverse arcuate ridge. (Lateral foveolae of vertex distinct and complete. Median carina of fastigium and occiput well marked.) (Peru.) ..... *Punacris* new genus

Body definitely compressed. Supplementary carinae of dorsum of thorax and abdomen either indicated on but part of these areas or absent. Prosternum with a median angulate or linguiform process, paired short spines or a single pronounced spine, never a low transverse ridge..... 9

9. Caudal tibiae lacking a distal spine on the external extensor margin. Fastigium, as seen from dorsum, not definite rostrate, the lateral margins throughout rectangulately or acute-angulate convergent. Prosternum never unispinose or bispinose..... 10

Caudal tibiae with a distal spine on the external extensor margin. Fastigium, as seen from dorsum, definitely rostrate, the lateral margins proximo-laterad subparallel and distad obtuse-angulately convergent. Prosternum unispinose or bispinose..... 12

10. Fastigium definitely trigonal in outline as seen from dorsum, its lateral margins straight convergent, not arcuate cephalad. Antennal articles normally 10. (Body relatively rugose. Lateral foveolae of vertex well marked.) (Peru.) ..... *Incacris* new genus

Fastigium as seen from dorsum with lateral margins more arcuately convergent cephalad, less broadly trigonal,[20] its disk narrower and more elongate. Antennal articles 8 to 9..... 11

11. Body appreciably but less strongly compressed. Lateral foveolae of vertex obsolete. Median carina of occiput continued cephalad to apex of fastigium. Prosternum with a low, transversely placed obtuse-angulate process. (Peru.) ..... *Crites* new genus

Body quite strongly compressed. Lateral foveolae of vertex well defined, ventral margin of same marked. Median carina of occiput not continued cephalad to apex of fastigium. Prosternum with a transversely placed and expanded, marginally rounded sublinguiform process. (Peru.) ..... *Paracrites* new genus

12. Antennae definitely depressed, subensiform. Fastigium with a medio-longitudinal carina, in profile moderately rostrate. Pronotum with a low medio-longitudinal carina on dorsum; flanking surface sculpture

[20] One of the two females of *Crites* which I have seen has the fastigium, as seen from the dorsum, more strictly trigonal than in the others, but in all other respects this individual is fully characteristic of *Crites*.

not definitely carinate, intermediate surface of disk not excavate. Prosternum bispinose. Caudal femora with a dorso-proximal compression,[21] dorsal margins at most not definitely serrato-dentate. (Chile.) ..... *Elysiacris* new genus

Antennae hardly at all depressed, not at all ensiform. Fastigium lacking a medio-longitudinal carina, in profile strongly rostrate. Pronotum with no medio-longitudinal carina on dorsum; marked caudad converging lateral carinae present, disk surface between these definitely and markedly excavate. Prosternum unispinose. Caudal femora lacking a dorso-proximal compression, dorsal margin serrato-dentate. (Chile.) ..... *Tropidostethus* Philippi

Sequence of Forms [22]

Bufonacris Walker
(*Lilaea* Stål.)
* *B. terrestris* Walker. (Straits of Magellan.)
* (?) *B. bruchii* Brancsik. (Chubut, Patagonia.)

Papipappus Saussure
* *P. clarazianus* Saussure. (Patagonia.)

Pappacris Uvarov
(*Pappus* Saussure, not of Distant.)
P. patagonus (Saussure). (Patagonia.)

Eremopachys Brancsik
E. bergii Brancsik. (Patagonia.)
E. simplex Brancsik. (Patagonia.)

Tristira Brunner von Wattenwyl
T. bergi Brunner von Wattenwyl. (Tierra del Fuego.)
* *T. magellanica* L. Bruner. (Straits of Magellan.)

Moluchacris new genus
(*Batrachopus* Philippi, in part.)
M. obesa (Philippi). (Andes of Central Chile.)
* *M. bufo* new species. (Coastal Central Chile.)
* *M. cinerascens* (Philippi.) (Central Chile.)

Peplacris new genus
* *P. recutita* new species. (Central Chile.)

Punacris new genus
(*Phrynotettix* Saussure, in part—not *Phrynotettix* Glover.)
* *P. peruviana* (Saussure). (Andean Peru.)

Incacris new genus
* *I. phaenogaster* new species. (Andean Peru.)

Crites new genus
* *C. prestoni* new species. (Andean Peru.)

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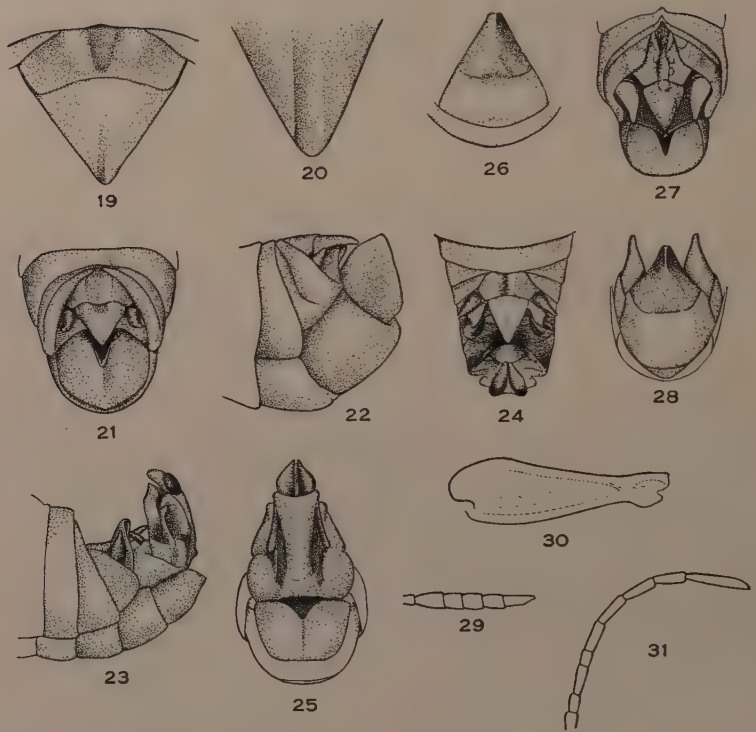
[21] See under generic treatment for comments on this feature.
[22] Of those species preceded by an asterisk I have examined material. All of these are represented in the Philadelphia collections.



Moluchacris bufo new genus and species. Male (*allotype*). Talcahuano, Chile. Fig. 19.—Supra-anal plate from dorsum (greatly enlarged).

Moluchacris cinerascens (Philippi). Male. Angol, Chile. Fig. 20.—Distal portion of supra-anal plate, as seen from dorsum (greatly enlarged).

Punacris peruviana (Saussure). Male. Oroya, Peru. Fig. 21.—Dorsal view of apex of abdomen (× 10). Fig. 22.—Lateral view of same (× 10).

Incacris phaenogaster new genus and species. Male (*paratype*). Fig. 23.—Lateral view of apex of abdomen with extended parts (× 10). Fig. 24.—Dorsal view of same (× 10). Fig. 25.—Caudal aspect of same (× 10).

Crites prestoni new genus and species. Male (*allotype*). Leonpampa, Peru. Fig. 26.—Caudal aspect of apex of abdomen (× 5).

Paracrites pichis new genus and species. Male (*type*). Pichis Trail, Peru. Fig. 27.—Dorsal view of apex of abdomen (× 10). Fig. 28.—Caudal aspect of same (× 10).

Elysiacris angusticollis (Blanchard). Female. Cerros de Nahuelbuta, Chile. Fig. 29.—Outline of antenna from dorsum (× 4½). Female. Mulchen, Chile. Fig. 30.—Outline of caudal femur (× 3).

Tropidostethus bicarinatus (Philippi). Female. Rio Valdivia, Chile. Fig. 31.—Outline of antenna from dorsum (× 4½).

Paracrites new genus
* *P. pichis* new species. (Ucayalan Peru.)
Elysiacris new genus
* *E. angusticollis* (Blanchard). (Central Chile.)
Tropidostethus Philippi
(*Batrachopus* Philippi, in part.)
* *T. bicarinatus* (Philippi). (South-central Chile.)

The status of Saussure's *Phrynotettix rana,* from Chile, is still uncertain, but very probably it is a member of the present group. I have discussed it in the generic treatment of *Punacris.*

Sources of material.—The greater portion of the limited but most important material examined is in the collection of the Academy of Natural Sciences of Philadelphia, or the Hebard Collection there deposited. Several of the Peruvian genera, which gave clues to many of the relationships, the Academy owes to the generosity and interest of the late Dr. B. Preston Clark, of Boston. Cornell University assisted with the loan of parts of the series of *Moluchacris, Punacris* and *Incacris,* and the loan of a pair of *Bufonacris* by the United States National Museum enabled me to check important variational features exhibited by the single adult pair of that genus in the Hebard Collection.

BUFONACRIS Walker

1871. *Bufonacris* Walker, Catal. Spec. Derm. Salt. Coll. Brit. Mus., v, Suppl., p. 89.
1875. *Lilaea* Stål, Bihang K. Svenska Vet. Akad. Handl., III, no. 14, p. 33. (Not *Lilaea* Walker, 1850.)
1888. *Bufonacris* Saussure, Mém. Soc. Phys. Hist. Nat. Genève, XXX, no. 1, pp. 124, 159.

GENOTYPE (by monotypy) : *B. terrestris* Walker.

Stål's genus *Lilaea,* based on *L. depressa* Stål described from a female without locality, is clearly a synonym of Walker's earlier *Bufonacris,* as shown by a careful study of Stål's description and Sjöstedt's recent illustration of the type of *depressa.*[23] Saussure pointed out their great similarity,[24] but persuaded that the presence or absence of an external distal spine on the caudal tibiae was a fundamental feature, he hesitated to create the synonymy which, however, he felt was very probable. In spite of the uncertainty

[23] Arkiv för Zoologi, 24A, no. 1, p. 24, pl. 5, fig. 7, (1932).
[24] Mém. Soc. Phys. Hist. Nat. Genève, XXX, no. 1, p. 99, (1888).

his formalism compelled him to separate the two genera quite widely in the classification then presented. Uvarov has recently given us his opinion that *Lilaea* is a synonym of *Bufonacris,* but advances no evidence on which this opinion is based.[25] As I am showing on a following page the presence or absence of an external distal spine on the caudal tibiae is not even a specifically constant feature in the genotypic species.

While Walker's original description of this genus, and type species, left much to be desired, and his statement that it "seems to be allied to *Graea* Philippi" was occasioned by purely superficial similarities, he was undoubtedly correct in giving the original locality for the type material of *B. terrestris* as Possession Bay, Straits of Magellan. Saussure in 1888,[26] convinced that the stirps *Eremobia* (the present day Batrachotetriginae), in which he then placed *Bufonacris,* was not present in South America, apparently cast about for a suitable "Possession Bay" in territory where he was convinced the inclusive group occurred. On the basis of an intimation received from the British Museum that the species was from the coast of Africa,[27] he concluded the bay back of Possession Island, Namaqualand, and which he referred to as Possession Bay (in modern atlases Elizabeth Bay), was the correct locality. Bruner in 1900 with four specimens of *B. terrestris* from Gregory Bay, Straits of Magellan, before him, pointed out that Saussure was unwarranted in discrediting Walker's citation of a Straits of Magellan locality for the species.[28] Brancsik in 1901, and without knowledge of Bruner's almost contemporaneous information, described a second species of *Bufonacris* and the new related genus *Eremopachys* from Patagonia,[29] and he also called attention to Saussure's error and the supporting evidence his material furnished on the southern South American habitat of these locusts.

While on first examination the very remarkable genus to which the name *Bufonacris* applies, bears very little superficial resemblance to *Papipappus,* on detailed comparison of the four specimens of *Bufonacris* to which Bruner referred, all of which are now before me, it is clear that the genus is a member of the same genera

[25] Ann. and Mag. Nat. Hist., (11), v, p. 176, 1940).
[26] Mém. Soc. Phys. Hist. Nat. Genève, xxx, no. 1, p. 160.
[27] Idem, p. 160, footnote 1.
[28] Second Rep. Merchant's Loc. Invest. Comm. Buenos Aires, p. 45.
[29] Jahresh. Naturw. Ver. Trencsener Comit., xxiii–xxiv, pp. 189, 191.

group and much less widely separated than would at first appear. Brancsik's *Eremopachys* I am discussing further in its proper position in the sequence.

When critically compared with *Papipappus* Saussure, its nearest relative, *Bufonacris* agrees in a considerable number of features, such as the head shape, the position and character of the eyes, the broad, transversely concave and strongly cephalad decurving fastigium, the basic sculpture of the face, the shape and sculpture of the frontal costa, the similarly broad but more decided and sub-lozenge-shaped thoracic nota and proximal abdominal tergite, the similar arrangement of the chief sculptural elements on the same, the almost identical prosternal development, the similar basic external genitalic construction, and the unusually diverging spine series on the extensor surface of the caudal tibiae. While certain distinctive characteristics of *Bufonacris,* as proportionate and surface sculpture details, which give to it an apparently extreme and disassociated ensemble, mask some of the similarities with *Papipappus,* a critical comparison of the two genera shows beyond any question their close relationship.

The analysis of generic characters presented by Saussure in 1888, to which reference is made above, as well as his summary of the features of the synonymic genus *Lilaea,* given in the same study, embrace the more essential characters of *Bufonacris,* so that it is unnecessary to repeat them here.

My colleague, Dr. H. Radclyffe Roberts has examined the internal genitalia of the male sex of the genotypic species, and he informs me its general pattern shows definite affinity and correspondence with the same parts of *Papipappus* similarly studied.

Walker described but a single species, the genotype, but he considered that a specimen or specimens with the "thorax and dorsum of the abdomen black," represented a variety,[30] which, however, he did not name. Kirby in 1910 applied to this variety the specific name *walkeri,*[31] basing it entirely on Walker's few words above quoted. In the meantime Brancsik, in 1901, had described another species of the genus as *B. bruchii,* from Patagonia.[32] The

[30] Catal. Spec. Derm. Salt. Coll. Brit. Mus., v, Suppl., p. 89, (1871).
[31] Synon. Catal. Orth., III, p. 295, (1910).
[32] Jahresh. Naturwiss. Ver. Trencsener Comit., XXIII–XXIV, p. 190, pl. III, figs. 4a, 4b and 4c, (1901).

latter species is quite distinct from *terrestris,* but Kirby's *walkeri* I feel represents only a color type of the category found in many flightless terrestrial, protectively colored types, such as the North American *Phrynotettix* and various species of Pamphaginae and Batrachotetriginae.

The two clearly distinct species can readily be separated by the following features:

Smaller: length of body, ♂ 22–25 mm., ♀ 30–36;[33] length of pronotum, ♂ 4, ♀ 5. Surface granulations of dorsum weaker. Frontal costa with lateral margins weak, not continuously defined, subobsolete ventrad, surface of costa concave only about median ocellus. (Straits of Magellan.)

terrestris Walker

Larger: length of body, ♂ 29 mm., ♀ 37; length of pronotum, ♂ 5, ♀ 7. Surface granulations of dorsum stronger. Frontal costa with lateral margins well marked and sharply defined, surface of costa concave in middle for much of its length. (Patagonia.).....*bruchii* Brancsik

The genus is apparently limited to the vicinity of the Straits of Magellan, Chile, and adjacent Patagonia in southern Argentina.

Bufonacris terrestris Walker

(Text-fig. 1; pl. III, figs. 1 & 2, pl. IV, figs. 7 & 8.)

1871. *Bufonacris terrestris* Walker, Catal. Spec. Derm. Salt. Coll. Brit. Mus., v, Suppl., p. 89. [♂; Possession Bay, Straits of Magellan[, Chile].]

1875. *Lilaea depressa* Stål, Bihang K. Svenska Vet.-Akad. Handl., III, no. 14, p. 33. [♀; Unknown locality.]

1888. *B[ufonacris] terrestris* Saussure, Mém. Soc. Phys. Hist. Nat. Genève, XXX, no. 1, pp. 124, 159, pl. 2, fig. 15. [♀; "(Possession Bay); terra Namaquensis."[34]]

1900. *B[ufonacris] terrestris* Bruner, Second Rep. Merchants' Loc. Inv. Comm. Buenos Aires, p. 45. [Gregory Bay, Straits of Magellan.]

1910. *B[ufonacris] walkeri* Kirby, Synon. Catal. Orth., III, p. 295. [♂; based on Walker's "var." from Possession Bay, Straits of Magellan.]

1932. *Lilaea depressa* Sjöstedt, Arkiv för Zoologi, 24A, no. 1, p. 24, pl. 5, fig. 7. [Figure of Stål's type of same.]

CHILE: Gregory Bay, Straits of Magellan; 1887–1888; (U. S. Fish Commission); 2 ♂, 2 ♀; [U.S.N.M. and Hebard Cln.].[35]

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[33] The latter figure is quoted from Stål's description of the unique type of *Lilaea depressa,* and it is within the realms of possibility his species may represent a distinct and otherwise unrecognized species. However, the thoracic width given by Stål is normal for *B. terrestris,* and the features stressed by him in his descriptions should preclude the consideration of *B. bruchii,* which has a more sharply defined frontal costa than *depressa.* Sjöstedt's figure of Stål's type shows definite agreement with female material of *terrestris,* and measurements of the figure, which is said to be natural size, are similarly in accord.

[34] See discussion of this reference above under generic treatment.

[35] These are the four specimens mentioned by Bruner (vide supra).

These specimens, having been dried from alcohol, are somewhat shrivelled and completely decolored.

As mentioned above under the generic discussion Uvarov has recently given as his opinion that *Lilaea depressa* Stål is the same as *Bufonacris terrestris,* although without any discussion of the matter. The evidence on spine variation given in the following paragraph, taken with comments presented in the generic treatment, give my reasons for considering Stål's genus and species to represent the present insect. Kirby's *walkeri* has already been discussed in the same treatment, being in every probability only an intensively colored phase of *terrestris.*

As to the presence or absence of a distal spine on the external margin of the caudal tibiae, the two pairs before me show such a spine markedly developed on both of these tibiae in one male, on the other of that sex distinct but small on the right tibia and with but a microscopic rudiment on the left one. One female has no trace on either tibia of a spine in the usual distal position, the other has the spine fully developed on the left tibia and entirely absent from the right one.

The measurements (in millimeters unless otherwise specified) given in past literature for this species and from the present series are as follows:

	Length of body	Length of pronotum	Greatest width across mesonotum	Length of caudal femur
♂, types, (ex Walker)	"12–14 lines"	—	—	—
♂, ex Saussure	22	—	11	12.5
♂, Gregory Bay, [Hebard Cln.]	23.8	4	10.9	14.1
♂, Gregory Bay, [U.S.N.M.]	25.1	4	10.7	14.6
♀, type of *Lilaea depressa,* (ex Stål)	36	—	13	—
♀, ex Saussure	30	—	13.5	17.5
♀, Gregory Bay, [Hebard Cln.]	34	5.2	13.3	16.4
♀, Gregory Bay, [U.S.N.M.]	33.5	5.2	13.3	16.1

I am unable to suggest what material furnished the basis for Saussure's measurements, as these could hardly have been drawn from Walker's material, Saussure's male dimensions being smaller than those given from that sex by Walker, and in addition Walker did not know the female.

This species may or may not be restricted to the area of the Straits of Magellan, but if not so restricted it probably extends northward a relatively short distance.

Bufonacris bruchii Brancsik

1901. *Bufonacris bruchii* Brancsik, Jahresb. Naturw. Ver. Trencsener Comit., XXIII–XXIV, p. 190, pl. III, figs. 4a, 4b and 4c. [♂, ♀; [Territory of] Chubut, Patagonia[, Argentina].]

Brancsik's figures show a species clearly more rugose and more scrofulose in sculpture than *B. terrestris,* with a more sharply defined frontal costa (see his figure 4b), while the measurements are greater than any available for the longer-known species. The characters given in the preceding key to the species of *Bufonacris* have been drawn from Brancsik's comparative diagnosis which contrasts *bruchii* with *terrestris.* That author noted that instead of a uniform coloration, which is apparently found in females, males of *bruchii* show three distinct light stripes on the upper surface extending distad to the last abdominal segment, and that the caudal femora of these individuals are trimaculate on their external faces. It is probable that this color phase is comparable to that of *B. terrestris* on which Kirby based his name *walkeri.*

It is possible that *bruchii* may be the *"B[ufonacris]* sp.?" referred to in 1900 by Bruner [36] as represented in the La Plata Museum by several specimens, which he stated were probably taken in the Territory of Chubut. I have before me from the Hebard Collection a male individual in the instar preceding maturity, and a female in the second preceding instar, both labelled "Chubut, Patagonia," purchased from a European dealer. These I feel very probably represent *bruchii,* although neither fully agrees with the original description, and even less with the original figures. Until I am acquainted with the adult condition of *bruchii* from material, I refrain from doing more than questionably referring these two specimens to *bruchii.* Both are, of course, very much smaller than the measurements given of *bruchii* by Brancsik, although the pro-

[36] Second Rep. Merchants' Loc. Inv. Comm. Buenos Aires, p. 45, (1900).

notal sculpture agrees quite fully, and the frontal costa is much more sharply defined and of greater evident extent than in *terrestris*.

PAPIPAPPUS Saussure

1884. *Papipappus* Saussure, Mém. Soc. Phys. Hist. Nat. Genève, XXVIII, no. 9, pp. 48, 101, plate fig. 13.

GENOTYPE (by monotypy): *P. clarazianus* Saussure.

On the basis of much of the gross external appearance alone the association of this genus with the other genera of the group would appear, like that of *Bufonacris,* entirely unwarranted. The form of the head, with its unusual structure of the fastigio-facial area may seem quite unreconcilable with that of other genera with a narrowly produced rostrum and a flattened trigonal or lanceolate fastigial dorsum. Relationship in this respect to *Bufonacris* becomes evident on comparison of the two genera. In addition comparison with *Tristira* and *Moluchacris,* quite different in general as these may seem to be, makes clear that the apparent isolation of *Papipappus* and *Bufonacris* is not fundamental, for while neither of the former genera has the head as broad and inflated, or the fastigium as deflexed and as little salient as in *Bufonacris* and *Papipappus,* there is appreciable similarity in numerous other elements of the facial sculpture, and the major features of that of the pronotum, as well as of the other nota, show an underlying similar pattern, masked considerably in both *Bufonacris* and *Papipappus* by superimposed rugosities or tuberculations. The transverse prosternal collar rim of *Bufonacris* and *Papipappus* differs from that of *Tristira* only in usually having a low but broad median emargination or crenulation,[37] instead of being continuous; while the caudal femora are essentially similar in general outline and sculpture in the two genera involved.

It is quite probable that many of the apparently distinctive features of both *Bufonacris* and *Papipappus* are slowly evolved responses to Patagonian habitat conditions.

But a single species of the genus has been described, and this is known from Argentine Patagonia as far north as the Territory of Neuquen.

[37] One male of *Bufonacris terrestris* examined by me has the margins complete and non-emarginate.

Papipappus clarazianus Saussure (Pl. V, figs. 12 & 13.)

1884. *P[apipappus] clarazianus* Saussure, Mém. Soc. Phys. Hist. Nat. Genève, XXVIII, no. 9, p. 101, plate fig. 13. [♂; Between the Rio Negro and the Rio Chubut (in error "Chubat"), Patagonia[, Argentina].]

ARGENTINA: Tucura Catanlil, Limay Centro, Neuquen; 1 ♂, 2 ♀; [A.N.S.P.].

These specimens have at some time been immersed in a liquid preservative, and in both sexes, but particularly the male, the abdomen was abnormally distended before drying. In other respects the present specimens agree very well with Saussure's measurements. Saussure has pointed out the species varies quite appreciably in the strength of the surface rugosities and sulcations.

Dr. Roberts has examined the internal genitalia of the male sex, and finds the genus clearly related, in this respect, to *Bufonacris,* similarly examined.

PAPPACRIS Uvarov

1884. *Pappus* Saussure, Mém. Soc. Phys. Hist. Nat. Genève, XXVIII, no. 9, pp. 48, 100. (Not of Distant, February, 1884.[38])

1940. *Pappacris* Uvarov, Ann. and Mag. Nat. Hist., (11) VI, p. 114. (To replace *Pappus* Saussure, not of Distant.)

GENOTYPE (by monotypy): *Pappus patagonus* Saussure.

As far as published information is concerned this genus is known only from Saussure's above cited original descriptions of the genus and genotypic species. As far as can be determined from these, and that of the clearly related genus *Eremopachys* of Brancsik, the two units can be distinguished by a number of features, the more important of which have been given in the preceding key to the genera. Brancsik contrasted his genus solely with the quite different *Bufonacris,* although its nearest relationship is certainly with *Pappacris.* For the features of the latter genus, which is unknown to me from material, I would refer the student to Saussure's description. But a single Patagonian species, the genotype, has been described.

[38] The exact date of issue of the portion of the Mémoires volume which consists of the "Prodromus Oedipodiorum" cannot be determined, either from the part itself or from the full volume. It was not received at the Academy until 1885, and doubtless came out late in 1884. Distant's use of the name *Pappus* (Biol. Cent.-Amer., Rhynch., Heteropt., I, p. 266) is dated February, 1884, and doubtless has priority over the use of the name by Saussure, and Uvarov's replacement is therefore in order.

Pappacris patagonus (Saussure)

1884. *P[appus] patagonus* Saussure, Mém. Soc. Phys. Hist. Nat. Genève, XXVIII, no. 9, p. 100. [♂; Rio Negro, Patagonia[, Argentina].]

Saussure's description presents all the information available on this species.

EREMOPACHYS Brancsik

1901. *Eremopachys* Brancsik, Jahresb. Naturw. Ver. Trencsener Comit., XXIII–XXIV, p. 188, pl. III, figs. 3a, b, c and d.

GENOTYPE (here designated): *Eremopachys bergii* Brancsik.

As stated under *Pappacris,* Brancsik in describing his *Eremopachys* compared it with the quite different *Bufonacris,* rather than with the much more nearly related *Pappacris* (=*Pappus* Saussure). All the published information available on *Eremopachys* is that given by Brancsik at the time the genus was described. It is unknown to me other than from his paper. On the basis of this, in the preceding key to genera, I have contrasted the more important differential features with those of *Pappacris.* Doubtless many others, and probably more important ones, exist, but without material only those mentioned in the description can be utilized. Brancsik's paper should be consulted for a summary of the generic characters and other originally given correlated information.

Two Patagonian species were described by Brancsik and none has been added since that time. Kirby in his Catalogue [39] by an oversight overlooked one of the two species described by Brancsik (i.e. *E. bergii*), but erroneously credited the four figures of *bergii* given by Brancsik as representing *E. simplex,* which was included in the Catalogue. Above I have selected the figured species (i.e. *bergii*) as the genotype.

The two species, which are known only from the female sex, can be distinguished by the following key, which has been drawn up from Brancsik's descriptions and comments.

Size larger (female body length, 46–52 mm.). Pronotum with the granulations relatively fine. Coloration ochraceous, with pattern more contrasted, fastigial margin and granulations of occiput and pronotum rubescent, caudal tibiae obscure with spines reddish. (Caudal femora with internal pagina blackish.) (Patagonia.) ..... *bergii* Brancsik

[39] Synon. Catal. Orth., III, p. 296, (1910).

Size smaller (female body length, 37 mm.). Pronotum with the granulations coarser and rougher. Coloration uniformly ochraceous, caudal tibiae with spines unicolorous. (Patagonia.) ..... *simplex* Brancsik

Eremopachys bergii Brancsik

1901. *E[remopachys] bergii* Brancsik, Jahresb. Naturw. Ver. Trencsener Comit., XXIII–XXIV, p. 190, pl. III, figs. 3a, b, c and d. [♀; Patagonia.]

We have no information on this species other than that given by Brancsik.

Eremopachys simplex Brancsik

1901. *E[remopachys] simplex* Brancsik, Jahresb. Naturw. Ver. Trencsener Comit., XXIII–XXIV, p. 189. [♀; Patagonia.]

Similarly this species is known only from the original description.

TRISTIRA Brunner von Wattenwyl

1900. *Tristira* Brunner von Wattenwyl, Commun. Mus. Nac. Buenos Aires, I, no. 7, p. 235.

GENOTYPE (by monotypy): *T. bergi* Brunner von Wattenwyl.

In 1907 [40] when pointing out the invalidity of Saussure's generic name *Phrynotettix* on account of the earlier *Phrynotettix* of Glover, I assumed that Saussure's genus was the equivalent of Brunner von Wattenwyl's subsequently erected *Tristira,* and therefore that the latter name should replace the preoccupied one. No material of *Punacris,* here erected, which equals in part Saussure's *Phrynotettix,* was then available. Kirby in his Catalogue [41] naturally followed my erroneous conclusion of 1907.

As the preceding generic key shows, *Tristira* and *Punacris* are quite distinct, well separated in a linear arrangement with numerous features of difference. However, Lawrence Bruner had previous to my comments referred to *Phrynotettix* a new species *magellanica,*[42] which I recognized in 1906 [43] as a member of the genus *Tristira.* As far as known Bruner had no other material of the genus in which he placed his new species and referred to as *Phrynotettix.* With material of Bruner's *magellanica* before me I can, in consequence, tabulate its apparent features of difference

[40] Entom. News, XVIII, p. 21, (1907).
[41] Synon. Catal. Orth., III, p. 211, (1910).
[42] Second Rep. Merchants' Loc. Invest. Comm. Buenos Aires, p. 43, (August, 1900).
[43] Proc. U. S. Nat. Mus., XXX, p. 383, (1906).

from *T. bergi,* the genotype, which was described almost contemporaneously. I know *bergi* only from the original description and figures, although, as discussed under *magellanica,* at one time I recorded the material now available as belonging to *T. bergi.*

One peculiarity possessed by *Tristira* which is hardly, if at all, indicated in related genera is the unusual resemblance of the lateral portions of the metanotum to brief alate structures. The lateral margin of the notum is thickened and well rounded caudad, there passing into the caudal margin of the same, but there is no internal separation of this apparently scale-like structure, which also has its illusion heightened by the presence of what might be considered a thickened and elevated discoidal ridge. It is evident, however, that this is not a true alate appendage, but merely a modification of the surface of the lateral portion of the metanotum which strongly suggests brevialation. The narrowly exposed portion of the mesonotum shows no analogous structure.

Key to Species

Cephalic and median limbs more slender and elongate, cephalic and median femora at least equal to the pronotal dorsum in length; caudal femora more robust. (Fuegia.).....*bergi* Brunner von Wattenwyl

Cephalic and median limbs stouter and shorter, cephalic and median femora shorter in length than the pronotal dorsum; caudal femora more slender. (Straits of Magellan.).....*magellanica* (L. Bruner)

Tristira bergi Brunner von Wattenwyl

1900. *Tristira bergi* Brunner von Wattenwyl, Comm. Mus. Nac. Buenos Aires, I, no. 7, p. 236, 2 figures. (October 9, 1900.) [♂, ♀; Filaret, Fuegia.]

The description of this species consists of but one and one-half lines, although the illustrations are of definite supplementary value. I have been quite unable to find a locality "Filaret" in Tierra del Fuego on any of the numerous charts consulted.

Tristira magellanica (L. Bruner)

1900. *Phrynotettix magellanica* L. Bruner, Second Rep. Merchants' Loc. Invest. Comm. Buenos Aires, p. 44. (August, 1900.) [♀; Straits of Magellan.]

CHILE: Gregory Bay, Straits of Magellan; (U. S. Fish Commission); 2♀; [A.N.S.P.].

Bruner's material was clearly from the same source as the specimens here listed, the species having been based on "a single female specimen of an insect now in my possession that was collected along with five others by some members of the U. S. Fish Commission steamer Albatross staff in the Straits of Magellan." In 1906 I studied and reported as *Tristira bergi* Brunner [44] one male and four females in the collection of the United States National Museum which bore the same information as Bruner's specimen. The two individuals listed above formed a part of this representation. Doubtless the "five others" referred to by Bruner were the five in the National Museum series in 1906, now in part in the Academy collection.

The original description of this species is fairly detailed, although in one respect I feel Bruner was misled by the method of preservation of the material he examined. He gives as part of his description; "foveolae of vertex with median longitudinal carina continued upon occiput." Of the two specimens before me one shows no trace of any occipital or fastigial median carina, the other has what is merely the type of low ridge produced by shrinking and buckling of the chitin, often noticed in specimens dried after protracted immersion in liquid preservative. All of the series from which the type of *magellanica* was selected were wet preserved, subsequently pinned and dried. The weakness of this low ridge in the single specimen exhibiting any trace of this feature, when compared with the emphasis of median occipital carinae in similarly treated specimens of forms which do possess normal median occipital carinae, shows very definitely that Bruner was misled by the condition of his unique specimen.

I feel *magellanica* is well distinct from *bergi,* but only the evidence of actual comparison will be conclusive. Certainly Brunner von Wattenwyl's figures indicate a species with longer and more slender cephalic and median femora than the material of *magellanica.* If the figures are faulty and the two forms inseparable Brunner's name would fall for the somewhat earlier *magellanica.*

MOLUCHACRIS [45] new genus

1863. *Batrachopus* Philippi (not of Blanchard, 1851), Zeitschr. Gesammt. Naturwiss., XXI, p. 242. [In part.]

[44] Proc. U. S. Nat. Mus., XXX, p. 383, (1906): Entom. News, XVIII, p. 21, (1907).

[45] From Moluche, *native name of the Araucanian people of Chile,* and *'ακρις, a locust.*

This striking and distinctive genus is more nearly related to *Peplacris,* here described, than it is to any other known to me. Linearly I would place it between *Tristira* and *Peplacris,* from the latter of which it can readily be distinguished by the features stressed in the preceding key to genera, i.e. the rounded, not at all rostrate, fastigio-facial angle, the bluntly and not sharply carinate fastigial margins, the less retreating face, the broad, well-defined and completely margined lateral foveolae of the vertex, the strongly developed lateral postocular carinae of the pronotum and the presence of numerous quite regular and longitudinally disposed rugose carinations on the meso- and metanota. From *Tristira* the broad, depressed form will at once distinguish *Moluchacris,* together with its non-ensiform antennae, definite median carina of the fastigium and occiput and the transversely truncate character of the lamellate process of the prosternum, while the incomplete and relatively disjointed abdominal carinations are quite different from the strongly, regularly and continuously carinate type seen in *Tristira.*

From *Punacris,* here described, *Moluchacris* is even more widely removed, and can at once be separated by having 14 to 15 antennal articles instead of the 8 or 9 of *Punacris.*

Generic characters.[46]—Form robust, broad, depressed. Apterous. Surface of dorsum in considerable part regularly rugoso-carinate. Head with fastigio-facial angle rotundato-angulate as seen in profile, facial line subarcuate ventrad, moderately retreating; lateral foveolae of the vertex marked, rectangulate, broad, subvertical in position, all margins well marked; fastigium transverse, its cephalic margins angularly carinate, median carina present on fastigium or occiput or on both (said to be not pronounced in *obesa*); frontal costa with margins subparallel for much of their length, sulcate. Antennae simple, slightly deplanate, with 14 to 16 articles.[47]

Pronotum as seen from dorsum transversely trapezoidal in outline, its greatest caudal width nearly or quite twice its median length, cephalic margin of disk and complete caudal margin subtruncate; median carina distinct, continuous, lateral or accessory carinae of disk subobsolete caudad, elsewhere marked, briefly subparallel cephalad then sigmoidally converging and continuing thence caudad more approximate and subparallel or even slightly diverging, surface on each side immediately ventrad of accessory carinae more or less definitely impressed in cephalic two-thirds, one (*cinerascens*) or

[46] The characters here given are drawn from the two species available, i.e. *bufo* and *cinerascens.* The features of *obesa,* which is known to me solely by the description, may or may not be fully in agreement in all respects.

[47] The norm is 14 or 15, with 13 or 16 rarely present, and probably the latter then only by supernumerary or adventitious subdivision.

two (*bufo*) longitudinal postocular carinate ridges cross the pronotal lateral lobes at their middle (in the case of one) or at and above the middle (in the case of two), these subobsolete near both margins, one transverse sulcus indicated on lateral lobes, severing the principal carinate ridge of the lobes but not the accessory or median carinae of the dorsum; immediate caudal section of almost the entire pronotum supplied with short, regularly spaced cariniform rugae. Mesonotum, metanotum and abdominal tergites to and including the penultimate one with a medio-longitudinal carina, more or less complete, the two first also with regular series of spaced more lateral carinulae; proximal portion of mesonotum normally not exposed and immediately beneath the caudal section of the pronotum in color shining black with paired red spots.

Abdomen with subobsolete continuations of the supplementary carinae of the nota also present. Supra-anal plate in both sexes divided in two transversely, distal section acute trigonal with a medio-longitudinal sulcus. Cerci in both sexes brief, conical. Subgenital plate of male subcompressed, with a deep ventral medio-proximal fossa which continues proximad and sharply divides the penultimate sternite into two parts. Ovipositor valves short, stout, margins entire, untoothed. Subgenital plate of female with distal margin triangularly produced mesad. Prosternal production transversely lamellate with the more elevated section of its margin truncate mesad. Mesosternal interspace shallow, in male subequal to and in female definitely broader than one of the mesosternal lobes; metasternal foveolae separated by a distance equal to two-thirds the width of the mesosternal interspace.

Cephalic and median limbs short, relatively stout, femora of female appreciably carinate. Caudal femora stout, definitely compressed, margins entire, paginal pattern pronounced and regular, ventro-external carina sublamellate arcuate; caudal tibiae with 7 to 8 external and 8 to 9 (rarely 10) internal spines, internal distal spurs subequal in length; tarsal claws equal in length, arolium well developed.

GENOTYPE: *Moluchacris bufo* new species.

Key to Species

1. Size larger (body length of ♂ 20 mm., of ♀ 31 mm.). Caudal femora with internal surface red. (No pronounced median carina on occiput.)
obesa (Philippi)

   Size smaller (body length of ♂ not exceeding 16.4 mm., of ♀ 25.7 mm.). Caudal femora without red on internal surface.....2

2. Whole form more rounded transversely, dorsum less tectate. Surface of pro-, meso- and metanota as a whole more definitely and regularly multicarinate. Outline of fastigium as seen from dorsum very broadly obtuse-angulate. Frontal costa relatively wider. Eyes more prominent as seen from dorsum. Two carinate longitudinal ridges crossing lateral lobes of pronotum, the ventral more marked. Prosternal production relatively lower. Ventral surface of caudal femora pale.
bufo new species

Whole form less rounded transversely, dorsum more definitely tectate. Surface of pro-, meso- and metanota as a whole less definitely and regularly multicarinate. Outline of fastigium as seen from dorsum but little more obtuse than a right angle. Frontal costa relatively narrower. Eyes less prominent as seen from dorsum. But one carinate longitudinal ridge crossing lateral lobes of pronotum. Prosternal production relatively higher. Ventral surface of caudal femora solidly blackish.

cinerascens (Philippi)

Of the three species placed in this genus *obesa* of Philippi is known to me solely by its description, and the features used to distinguish it in the preceding key have been drawn from that source. Philippi's *cinerascens* in a linear arrangement clearly stands at the end of the series toward *Peplacris,* to which certain of its features, as the general form, sculpture and fastigial form, show definite approach. However, *cinerascens* is clearly nearer *Moluchacris bufo* than it is to *Peplacris,* and its position in the present genus is not open to question, although it indicates the basic affinity of the two genera.

As far as is known at present in distribution this genus is confined to Chile.

Moluchacris obesa (Philippi)

1863. *B[atrachopus] obesus* Philippi, Zeitschr. Gesammt. Naturwiss., XXI, p. 243. [♂, ♀; Andes of the provinces of Santiago and Colchagua, Chile.]

The original description of this species stated it is a broader, thicker, larger and smoother species than *M. cinerascens,* with which it was compared. The head was said to have no distinct medio-longitudinal carina on the occiput, while the pronotum was described as broader and flatter, with more strongly developed lateral angles. The caudal femora were said to have the inner surface bright red, the caudal tibiae usually violet, occasionally blackish.

Evidently *obesa* is a larger form nearly related to *M. bufo,* but as far as can be gleaned from the description it is quite distinct. It may be limited to the Andean portion of central Chile.

Moluchacris bufo[48] new species
(Text-figs. 2, 3 & 19; pl. VI, figs. 17–18, pl. VII, figs. 21–22.)

The chief characteristics separating *M. bufo* from *M. cinerascens* have been given in the key to the species. In general it has a more rounded, less angular form than *cinerascens,* with a broader head, blunter fastigium, more prominent eyes and more completely multicarinate, yet less asperous, sculpture.

Type.—♀; Talcahuano, Province of Concepción, Chile. December, 1903. (Carlos S. Reed.) [Academy of Natural Sciences of Philadelphia, Type no. 5668.]

Size medium; form broad, blunt fusiform; surface with its most striking feature the series of subparallel cariniform longitudinal rugae on the thoracic nota and the proximal abdominal tergite.

Head broad, its greatest width across genae subequal to that across eyes, dorsal length of head equal to seven-tenths the latter, occiput and fastigium with medio-longitudinal carina marked and reaching to the fastigial apex, in profile evenly low arcuate; fastigium broad obtuse, its greatest median length cephalad of cephalic point of eyes equal to but little more than a third the fastigial width at the cephalic point of the eyes, cephalic fastigial margins definitely carinate, the very short juxta-ocular accessory carinae fusing with the cephalic fastigial borders briefly mesad of the latters' termini at the eyes, disk of fastigium laterad of median carina moderately and transversely subexcavate, not encroaching at all upon the full and rounded occiput; fastigiofacial angle rounded obtuse-angulate, in outline evenly passing to the moderately oblique and subarcuate facial line; lateral foveolae of the vertex relatively broad, greatest caudal depth equal to two-thirds their length, dorsal and ventral margins carinately evident, surface moderately impressed, subrugulose; frontal costa with width between antennal bases slightly greater than that of proximal antennal article, margins faintly converging in the region of the median ocellus then equally diverging toward clypeal suture, surface sulcate, deeply so between interantennal region and median ocellus. Eyes moderately prominent as seen from dorsum, in basal outline broad rounded subtrigonal, the greatest breadth and depth being subequal to one another and to one and two-thirds times the immediate infra-ocular depth of the genae. Antennae in length equal to about one and one-half times the dorsal length of the head.

Pronotum with greatest caudal width across ventro-lateral angles but slightly less than twice the median length, which latter is one and two-fifths times that of dorsum of head; median carina well marked, entire; accessory or lateral carinae of pronotal disk definitely subsigmoid, subparallel in their brief cephalic section, then concavely incurving and convexly outcurving, becoming obsolete shortly before caudal margin; short spaced cariniform rugae along caudal margin of pronotum distinct, relatively regular in disposi-

[48] In allusion to its toad-like form, *Bufo* being the generic name of the typical toads.

tion and evident well down on lateral lobes: pronotal lateral lobes slightly narrower than elevation of pronotum as seen in profile, cephalic and caudal margins of lobes weakly converging in ventral half, ventro-cephalic and ventro-caudal angles rounded obtuse-angulate, ventral margin weakly obtuse-angulate; surface of lateral lobes with two definite but incomplete longitudinal postocular carinate ridges, the more dorsal,[49] which is also the weaker, less definitely cut by the single transverse sulcus, that is evident only on the lateral lobes, the more ventral ridge stronger, more definitely a shoulder, and distinctly and rather deeply cut by the transverse sulcus, the plane of the lateral lobes ventrad of the latter ridge appreciably insloping. Meso- and metanota strongly transverse, the exposed portion of the mesonotum little more than half the length of the metanotum, the median carina and three pairs of more lateral longitudinal and roughly subparallel carinulae well marked. Proximal abdominal tergite with the median carina and the more lateral of the secondary carinulae well marked, the others less definite; remainder of abdomen with median carina continued distad and surface with less distinct numerous low subnodulose rugulae in general continuation of the dorsal sculpture of the nota. Surface of pleura moderately impresso-punctate.

Prosternum with the truncate section of the production relatively broad and low, forming a rim-like border, the cephalic face of the production more sloping and less vertical than the caudal. Interspace between mesosternal lobes slightly more than twice as wide as deep, internal and caudal margins of lobes broadly rounded.

Supra-anal plate sharply acute trigonal distad, the median transverse division deeply cut and normally accentuated by a difference in the planes of the two portions; cerci very short, mere rounded knobs, not more than one-third as long as the distal half of the supra-anal plate.

Caudal femora robust, moderately compressed, in profile the greatest depth contained approximately three times in the femoral length, least pregenicular depth equal to half the greatest depth, proximal portion of femur relatively heavy; dorsal margin in profile low arcuate, ventro-external margin more strongly arcuate, sublamellately elevated, the ventro-lateral face much broader mesad than proximad or distad, ventral border of external pagina nearly straight, pattern of pagina quite regularly chevroned, distal extremity of genicular lobes rounded rectangulate, lobes deepest at proximal third. Caudal tibiae with 8 external and 9 internal spines.

Allotype.—♂; same data as type. [Academy of Natural Sciences of Philadelphia.]

Differing from the description of the female type in the following noteworthy respects.

Size smaller; form similar but proportionately less robust; surface sculpture essentially the same.

[49] This more dorsal ridge varies greatly in emphasis in the series. It is never completely absent and often strongly marked, but is never the outstanding sculptural feature of the lobes, as is the more ventral ones.

Head with greatest width across genae equal to but five-sixths the width across eyes, greatest dorsal length of head equal to two-thirds the latter; fastigium and occiput with median carina less arcuate in profile, accessory rugae of same area more sharply indicated; fastigial form as seen from dorsum similar to that of female, but fastigio-facial angle, as seen in profile, slightly less rounded yet obtuse-angulate, facial line slightly more oblique than in female; frontal costa proportionately narrower than in female, the width between antennal bases no wider than proximal antennal article; eyes definitely more prominent than in female, the greatest transverse width of one, as seen from the dorsum, subequal to the distance at the vertex between the eyes, base outline of eye as in female except that the dorso-cephalic angle is more distinctly rounded, the depth equal to twice the immediately infra-ocular depth of the genae. Antennae slightly longer than one and one-half times the dorsal length of the head.

Pronotum with greatest caudal width across ventro-caudal angles equal to one and two-thirds times the median length, dorsal length of pronotum equal to one and seven-tenths times that of dorsum of head; sculpture of pronotal dorsum as in female: lateral lobes of pronotum slightly narrower and proportionately deeper than in female, caudal margin weakly sigmoid and not definitely converging toward cephalic margin in ventral half, ventro-caudal angle more narrowly and sharply rounded than in female, ventral margin more subsigmoid than obtuse-angulate; sculpture of lateral lobes as in female but slightly sharper and with accessory nodules more evident. Meso- and metanota as in female, particularly in sculpture, but slightly less strongly transverse in proportions. Proximal abdominal tergite less transverse than in female but with similar sculpture.

Interspace between mesosternal lobes less strongly transverse than in female, somewhat less than twice as wide as deep.

Supra-anal plate trigonal, very slightly broader across base than median length, and in profile narrowly decurved distad, transverse division of plate by a marked concave sulcation placed at two-fifths of length from base, proximal section in median half with a pair of low rounded bosses, distal section with a shallow medio-longitudinal sulcation distad. Cerci short, slightly longer than in female, simple, conical, apex bluntly acuminate. Subgenital plate [50] subcompressed, in profile the dorsal and dorso-distal outlines join in an obtuse-angle and from the dorsum the former shows it is made up of the narrow, more distal borders of the two closely appressed dorso-lateral borders of the genital chamber, these borders strongly decurving proximad under the infracercal plates, ventro-distal aspect of subgenital plate and median area of ventral surface of penultimate sternite deeply fissate by a marked infolding of the integument.

[50] The male allotype has had the internal genitalia removed, and the fissate character of the surface of the disto-ventral aspect of the subgenital plate and of the penultimate sternite, evident in all the other males of the genus which I have seen, is not conspicuous. Manipulation to remove the internal parts apparently has stretched or unfolded the chitin so that the usual fissation is not apparent. In consequence the latter is here described as seen in the paratypic males.

Cephalic and median femora appreciably stouter and more inflated than in the female. Caudal femora somewhat deeper than in female, greatest depth contained two and two-thirds times in femoral length, other femoral features as in female.

Coloration.—Above dully inconspicuous tawny-olive mottled with mummy brown to almost uniform mummy brown, averaging paler and more tawny-olive in the males, the mottling in the latter sex more appreciably following sculptural features, particularly the external side of the accessory carinae of the pronotal disk, the palest tone sometimes most evident on carinate ridges; ventral surface less mottled and infumate than dorsum, more brownish. Eyes ranging from cinnamon-buff to tawny-olive mottled with bister. Normally covered portion of mesonotum, that is by caudal section of pronotum, and less definitely the adjacent similar sections of the pleura shining black, with mesad on each side of the median carina a single pair of subcircular spots of vivid scarlet. Limbs as a whole colored like the body, the femora rather sparsely picked or sprinkled with dots of fuscous, the caudal pair with weak streakings of the same; ventral surface of caudal femora ranging from buckthorn brown to dresden brown, never black, internal face of caudal femora largely or almost entirely blackish fuscous, caudal tibiae of the general tone with the spines narrowly fuscous-tipped.

Measurements (in millimeters)

In addition to the dimensions of the type and allotype the following are those of the extremes in size in both sexes.

	Length of body	Length of pronotum	Greatest breadth of pronotum	Length of caudal femur
♂, Talcahuano, *allotype*	15.8	2.93	4.7	7.8
♂, Talcahuano, *paratype*	14.2	2.77	4.7	7.8
♂, Lota, *paratype*	16.4	2.93	4.9	7.9
♀, Talcahuano, *type*	22.5	3.74	7	9.9
♀, Talcahuano, *paratype*	22.1	3.74	7	9.9
♀, Talcahuano, *paratype*	25.7	3.91	7.3	10.4

In addition to the type and allotype I have before me one male and fifteen females bearing the same data as the type; two females from Concepción, Chile, taken without record of date by Carlos S. Reed; four males from Coronel, Concepción Province, Chile, taken in January, 1904 by the same collector; one male from Lota, Concepción Province, Chile, taken the same month by the same collector, and one immature male from Penco, Concepción Province, also taken by Reed in December, 1903. These are all considered paratypes and are in the collection of the Academy. In addition I have before me, from the collection of Cornell University, one female, dried from alcohol, taken in Valparaiso Province,

Chile by A. Paz. The latter on account of its method of preservation has the chitin somewhat buckled and contracted, and the general appearance of rugae and depressions rather different from what is seen in those taken by Reed, none of which has at any time been immersed in a liquid preservative.

The dimensions given above show the relatively limited amount of size variation found in a series taken in a circumscribed area, i.e. from Lota to Penco, but in a broader areal representation size might prove to be less uniform.

Attention has already been drawn to the variation noticed in the number of antennal articles. This is clearly due to the extent of subsidiary division which often cannot be distinguished from primary segmentation in this group. Most of the males in the present series show 14 or 15 clearly present, often 14 in one antenna and 15 in the other; the allotype shows 16 in each and one male from Coronel with but one antenna remaining shows but 13 in this. The count in the females ranges from 14 to 16, the majority with 15, the type alone with 16 in both antennae; two others have 16 in one and 15 in the other, while a single female has but 14 in both antennae.

Except for a single Coronel male which has 10 internal spines present on one caudal tibia, all the specimens seen agree in having 8 external and 9 internal spines.

Possibly this species may be limited to the vicinity of the seacoast, but it ranges from Valparaiso to Concepción Provinces, Chile.

Moluchacris cinerascens (Philippi)

(Text-figs. 4, 5 & 20; pl. VI, figs. 19 & 20, pl. VII, figs. 23 & 24.)

1863. *B[atrachopus] cinerascens* Philippi, Zeitschr. Gesammt. Naturwiss., XXI, p. 242. [♂, ♀; Santiago Province, Chile.]

CHILE: Coronel, Concepción Province; I, 1904; (C. S. Reed); 2 juv. ♀; [A.N.S.P.]. Angol, Malleco Province, elev. 500 meters; XI, 1, 1929; 1 ♂, 2 ♀; [A.N.S.P.]: X, 25, 1938; (H. Topp); 1 ♀; [A.N.S.P.]. Chiguaihue Hills, west of Collipulli, Malleco Province; III, 14, 1931; (D. S. Bullock); 1 juv. ♂; [A.N.S.P.].

The preceding key to the species of the genus gives the more conspicuous features which separate *M. cinerascens* from *bufo,* and the recognition of the present species should not be difficult, par-

ticularly when reference is made to the accompanying figures of both sexes of the two species.

This form is somewhat more angular in its appearance than *bufo,* and its more tectate body gives to the whole a quite different facies, while the dorsal thoracic and abdominal sculpture is distinctive. The single adult male available has the basal portion of the supra-anal plate retracted and hidden, but its distal section is more sharply acute trigonal than in *bufo.* In profile the male subgenital plate has its distal angulation rectangulate and in consequence much more marked than in *M. bufo.* The caudal femora in both sexes have the arcuation of the ventro-external carina much less pronounced than in *bufo* and not at all sublamellate. The number of external spines on the caudal tibiae is usually 8, as few as 7 in one tibia of one female; the number of internal ones is usually 9, as few as 8 in one adult and one immature female, and in one tibia of the immature male. The number of antennal articles is usually 13 in adults, 12 in one antenna of a female lacking the other one; immature individuals have 12 articles and the whole antenna in these is definitely depressed, suggesting the condition seen in adults of *Elysiacris.*

All of the adults and one of the immature females have the ventral surface of the caudal femora and by far the greater portion of the internal face solidly shining black, except for a narrow pregenicular pale buff band. The immature male and one immature female have the ventral surface brownish, but the internal face is shining black as in the adults.

The measurements (in millimeters) of the Angol male and the figured female are as follows:

	Length of body	Length of pronotum	Greatest breadth of pronotum	Length of caudal femur
♂, Angol	16.4	3.26	6	8.9
♀, Angol	23.8	4.07	8.1	11

Apparently this species occurs both near the coast and in the Central Valley, but in the present imperfect state of our knowledge nothing definite geographically can be given other than localities from which it has been examined.

PEPLACRIS [51] new genus

This genus is more nearly related to *Moluchacris* than to any other member of the group, agreeing in general form, prosternal development, basic fastigial type, general carination of dorsum and type of antennae, but differing in the more produced and rostrate fastigium, which has sharply carinate lateral transverse carinae, strongly retreating face, less marked lateral foveolae of vertex, which have the ventral margin subobsolete, the less sharply marked postocular carinae on the pronotum and the less strongly transverse mesosternal interspace.

GENOTYPE: *P. recutita* new species.

Generic characters.—Form moderately robust, fusiform in dorsal aspect, subdepressed. Apterous. Surface of dorsum with numerous short, often scattered, clearly molded carinulae. Head with fastigio-facial angle rectangulate as seen in profile, briefly rounding ventrad into the straight oblique and definitely retreating facial line, fastigial surface nearly plane; lateral foveolae of vertex oblong, poorly defined, ventral margin incomplete, vertical plane of foveolae oblique, facing ventro-cephalad; fastigial form transverse trigonal, cephalic margins sharply carinate, median carina more distinct on occiput than on fastigium, but indicated on both; frontal costa narrow, margins subparallel for much of their length, confluent dorsad, slightly diverging ventrad, surface between sulcate. Antennae simple, subdeplanate, 14 articles.[52]

Pronotum transversely trapezoidal in outline, its greatest caudal width over all equal to slightly more than one and one-half times the median length, cephalic margin of disk broadly obtuse-angulate, complete caudal margin of disk subtruncate with a slight median production; median carina low but distinct and continuous, lateral or accessory carinae of disk obsolete caudad, distinct cephalad, regularly but unevenly converging in the caudal portion of their evident development, mesad separated by but half the interspace at cephalic margin, surface of each side in cephalic half immediately latero-ventrad of accessory carinae lightly but definitely impressed; lateral lobes with weak indications of an incomplete median longitudinal carinate ridge, not reaching either margin, one transverse sulcus weakly indicated on lateral lobes, severing the weakly marked carinate ridge of the lobes, but not reaching the carinae of the dorsum; immediate cephalic and caudal sections of almost the entire pronotum supplied with short, regularly spaced cariniform rugae. Mesonotum caudad to antipenultimate abdominal tergite with a distinct medio-longitudinal carina; more lateral portions of meso- and metanota and proximal abdominal tergite with low rugulae, more marked as spaced

[51] From πέπλος, *cloak* or *robe,* and ἀκρίς, *a locust,* in allusion to the character of the integument.

[52] Several more could be counted if secondary divisions were included.

short rugae near the caudal margin of each, lateral portions of surface of other abdominal tergites with numerous low circular nodes and less clearly defined short rugulae.

Supra-anal plate (female only known) trigonal, divided in two transversely, distal section trigonal. Cerci (female alone known) very brief, conical. Subgenital plate of female triangularly produced mesad. Ovipositor valves short and stout, margins entire and untoothed. Prosternal production a transverse lamellate structure with its margin mesad sharply truncate. Mesosternal interspace transverse but shallow, slightly broader than one of the mesosternal lobes; metasternal foveolae separated by a distance no more than half the width of the mesosternal interspace. Cephalic and median limbs short, femora rather slender proximad,[53] weakly carinate.

Caudal femora stout, moderately compressed, margins entire, paginal pattern distinct but not deeply etched, ventro-external face moderately expanded in female (male not known), surface of same obliquely deplanate in transverse section, ventro-external carina hardly at all sublamellate; caudal tibiae with 7 external and 8 internal spines, internal distal spurs subequal in length; tarsal arolia well developed, tarsal claws of equal length.

But a single species of this genus, from Chile, is known to me, and this from a solitary female individual. The genus is clearly near *Moluchacris* but sufficiently distinct to be worthy of separation. It is clearly a connecting link in the series of genera here discussed, having features which show relationship in both linear directions, although nearer *Moluchacris* than *Punacris*, which here follows.

Peplacris recutita [54] new species (Text-figs. 6 & 7; pl. V, figs. 14 & 15.)

Type.—♀; Province of Valparaiso, Chile. (A. Faz.) [Academy of Natural Sciences of Philadelphia, Type no. 5669.]

Size medium; form slightly depressed, fusiform; surface ruguloso-carinulate or subtuberculate, in addition to the carinal features detailed below.

Head relatively narrow (for group), its greatest width across genae subequal to that across eyes, and this to nine-fifteenths of the head depth, greatest dorsal length of head equal to seven-ninths the head width, occiput faintly sloping cephalad to fastigium, the medio-longitudinal carina well marked on the occiput, becoming broken and indistinct cephalad on the fastigium, distinct caudad converging well-elevated carinae extend postocularly to the caudal portion of the occiput opposite the accessory pronotal carinae; fastigium as seen from dorsum with its straight converging, sharply

[53] This is compared with *Moluchacris*, which has heavier median and cephalic femora.

[54] Meaning *galled and healed over and over again*, in allusion to the scarred appearance of the surface of much of the integument.

carinate, cephalic margins joining in a right angle, greatest median fastigial length cephalad of a line joining the cephalic points of the eyes equal to five-eighths the fastigial width at the same point of the eyes, the short juxta-ocular accessory carinae not sharply marked and not definitely fusing with the cephalic fastigial borders, disk of fastigium laterad of the obscure median carina but slightly excavate and with the characteristic surface sculpture; fastigio-facial angle in profile very narrowly rounded rectangulate, the facial line ventrad very briefly subvertical then markedly and obliquely straight retreating; lateral foveolae of vertex oblong, the overhanging dorsal border, this being the fastigial margin, straight, the incomplete subobsolete ventral border roughly sigmoid, surface not definitely excavate but sculpture as on general body surface; frontal costa immediately dorsad with margins in contact, between antennal bases narrowly fossulate expanded, definitely narrowed thence ventrad to a point half way between the median ocellus and the clypeal suture, whence ventrad the costal margins moderately diverge, costa definitely and evenly sulcate ventrad of the extreme vertex; accessory (lateral) facial carinae broken and subobsolete. Eyes but moderately prominent as seen from dorsum, in profile with basal outline subtrigonal ovoid, the greatest breadth contained one and a third times in the greatest length of the eye, while the depth of the infra-ocular sulcus is subequal to the width of the eye outline. Antennae subequal to one and one-half times the dorsal length of the head, distal article relatively long.

Pronotum with disk one and one-half times as long as the normally exposed dorsal surface of head, dorsal line in profile low arcuate; width of disk (dorsal surface) at cephalic margin equal to but four-ninths that across eyes, in transverse section the same portion of the disk is very low tectate; accessory (lateral) carinae of disk cephalad as distinct as the continuous median carina, these sigmoidally and equally but unevenly converging to a median separation of but half the interval at cephalic margin, thence caudad slightly diverging before becoming obsolete, the carinae progressively less marked caudad toward the vanishing point: in profile the whole pronotum is seen to be slightly deeper than the dorsal length of the same, and equal to about one and one-half times the median breadth of one of the lateral lobes, cephalic margin of latter appreciably sigmoid, ventro-cephalic angle obtuse, ventral margin sigmoid, ventro-caudal angle narrowly rounded rectangulate; median longitudinal carinate ridge of lateral lobes weak and broken, surface of lobes ventrad of same subvertical. Mesonotum with length of normally exposed dorsal surface equal to one-third that of pronotum, of metanotum equal to five-ninths that of pronotum, the mesonotum strongly transverse, its median length contained three and three-fifths times in the mesonotal width, while the metanotum has the width but slightly more than twice its median length. Pleura with surface cribrosely impressed rugoso-punctate. Proximal abdominal tergite with the width of its dorsal surface at cephalic border equal to three times the median length of the tergite, the caudad-converging cariniform lateral borders of the dorsum fairly well marked.

Prosternal production with the median transverse structure well developed, definitely lamellate, its distal margin subtruncate with a faint concavity,

cephalic face of production obliquely deplanate. Mesosternal interspace transversely rectangulate, its depth equal to half its width, internal margins of lobes subparallel but slightly arcuate, sharply rounding over the angles to the subtransverse caudal margins. Metasternal foveolae closely placed, separated by not more than half the width of the mesosternal interspace.

Supra-anal plate with median length equal to one and one-fourth times the greatest width, which is briefly proximad of the insertion of the cerci, transverse division at two-fifths the length from the base, distal section trigonal, faintly shorter than its proximal width, apex blunt acute, converging margins nearly straight, surface of distal section subexcavate meso-proximad, of proximal section with a shallow medio-longitudinal sulcation, lateral portions of this section subdeplanate. Cerci short, stout, blunt conical, in position faintly diverging. Ovipositor valves very short, stout, in profile the dorsal pair have the distal points moderately recurved, ventral pair as seen from below very stocky, distal section broader proximad than long, falcation of apices moderate; lateral plates of ventral valves stout, lanceolate, blunt acute distad. Subgenital plate with halves of distal margin sigmoidally converging to the short median production.[55]

Cephalic femora with proximal portion somewhat compressed as seen from the dorsum. Median femora similarly subcompressed in same view, carinations more pronounced than on cephalic femora, an even increase in femoral depth distad marked, the length equal to one and one-fifth times that of cephalic femora. Caudal femora with greatest depth contained almost two and nine-tenths times in the femoral length, depth at pregenicular constriction slightly less than half that mesad, greatest breadth of ventro-external face equal to faintly more than half that of the external paginal face, ventral border of the pagina definitely carinate elevated, paginal pattern distinct but irregular in emphasis, apex of genicular lobes rounded rectangulate; caudal tibiae relatively slender as seen from dorsum but with depth as in *Moluchacris*.

Coloration.—General dorsal color hay's russet, paling on the dorsum of the head and the narrow pronotal disk to cinnamon-rufous, washed slightly with weak mummy brown along the ventral side of the postocular carinae of the head and the more definite cephalic section of the accessory carinae of the pronotum; venter nearer cinnamon-rufous, face approaching snuff brown. Antennae cinnamon-buff, eyes ochraceous-tawny. Limbs of the general color except that the caudal tibiae approach olive-buff dorsad and on the external surface, while ventrad and on the internal face they are deep dusky orient blue (Ridgway), spines olive-ocher, black tipped.

Measurements.—Length of body, 21.8 mm.; length of pronotum, 3.34; greatest caudal width of pronotum, 5.7; length of caudal femur, 9.1.

The type of *Peplacris recutita* is unique, and the discovery of the male is awaited with interest.

[55] This plate is somewhat compressed in the unique type, and its normal surface condition cannot be determined.

PUNACRIS new[56] genus

1888. *Phrynotettix* Saussure, Mém. Soc. Phys. Hist. Nat. Genève, xxx, no. 1, pp. 17, 29. (In part.[57]) [Not *Phrynotettix* Glover, Illustr. N. Amer. Orth., pl. 6, fig. 25, (1872).]

This genus holds a definitely intermediate position between the *Papipappus-Moluchacris* assemblage which precedes it in the present arrangement, and the *Incacris-Tropidostethus* one which follows it, being, however, nearer the former except in one relatively important respect, i.e. the number of antennal articles. It agrees with the *Papipappus-Moluchacris* aggregation in the relatively robust, uncompressed body, which, however, is not truly depressed, the general character of the accessory carinae of the pronotal disk, and of the fastigium, of the limbs form, particularly of the caudal femora, and of the ovipositor valves. Its approach to the *Incacris-Tropidostethus* assemblage is indicated by the reduced number of antennal articles (i.e. 8 or 9). I feel it has been derived from a *Moluchacris* or *Peplacris*-like ancestor, and that its evolutionary history has run contemporaneously with that of the *Incacris-Tropidostethus* aggregation. This, however, is purely hypothetical, and a far greater knowledge of the group as a whole must be acquired before more concrete conclusions on this matter can be reached.

Generic characters.—Form robust, relatively broad, not at all compressed and while broad hardly depressed, as seen from dorsum in general broad fusiform. Apterous. Surface of dorsum in large part rugoso-carinate,

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[56] From Puna, *the local Peruvian name for the Andean paramo country,* and *'ακρίς, a locust.*

[57] The genus *Phrynotettix* of Saussure was proposed in 1884 (Mém. Soc. Phys. Hist. Nat. Genève, xxviii, no. 9, pp. 47, 99) for the single new species *P. rana* from Chile. However, this generic name is preoccupied by *Phrynotettix* Glover, 1872, and consequently must fall. In 1888 (vide supra) Saussure broadened his concept of the genus and included a second species, *P. peruviana,* from Peru. In the same work figures were given of both of the species which he had referred to the genus (i.e. pl. 2, figs. 7, 7a, 7b and 7c of *P. rana* and figs. 8, 8a and 8b of *peruviana*). The two diagnoses and the figures show very definitely these species are not congeneric, and that while *rana* shows some tendency toward *Moluchacris* here described, in other respects it is quite different from any form I have examined, although it may prove to be a member of one of the other genera here treated. Whether the entity, of which *rana* is by monotypy the type, is identical with some one of the latter, or is a distinct unit of equal value, I am unable to say at this time. A re-examination of the type of *rana,* in Vienna, is not possible at this time. The Saussurean generic name, however, as shown above, is in any circumstance invalid on account of preoccupation.

Saussure's second species included in his *Phrynotettix,* on the other hand, is that on which the new genus *Punacris* is here erected.

ruguloso-carinulate or low tuberculate, this sculpture extending less definitely to certain parts of the lateral aspects, in some areas the sculpture being longitudinally and linearly disposed, in others angularly or irregularly placed. Head relatively broad, eyes little prominent, subtrigonal in basal outline; fastigio-facial angle in profile narrowly rounded rectangulate, facial line with a brief dorsal subvertical section then ventrad moderately oblique retreating; lateral foveolae of the vertex marked, transverse rectangulate, margins well indicated, surface shallowly excavate; cephalic outline of fastigium as seen from dorsum right angled, its area definitely broader than long in both sexes, medio-longitudinal carina indicated from fastigial apex to base of occiput, short juxta-ocular carinae well marked; frontal costa narrow throughout but widening ventrad, sulcate. Antennae simple, moderately depressed, stout, composed of 8 or 9 articles, the distal one at least as long as the two preceding ones.

Pronotum trapezoidal in outline as seen from dorsum, greatest caudal width (over all) approximately one and one-half times the median length, cephalic margin of disk, and entire caudal margin as seen from dorsum, roughly subtruncate; median carina of pronotum distinct but uneven in emphasis, lateral or main accessory carinae of disk marked, entire, nearly or quite equal to extent of separation cephalad and caudad, markedly inbowed mesad, where they are separated by hardly, if any, more than half the width intervening at the cephalic margin; lateral lobes subquadrate, moderately deeper than dorsal length, slightly narrowing ventrad, ventral margin strongly sinuate, surface dorsad with a more or less definitely marked supplementary longitudinal carina, which approximately parallels the lateral carinae of the disk ventro-laterad, these supplementary carinae slightly diverging caudad when seen from the dorsum, and in emphasis ranging from subobsolete, and then indicated only by scattered sections, to complete and continuous structures from margin to margin, surface of lobes briefly ventrad of these accessory carinae with a low reversed V-shaped swelling, which is bisected mesad by the one clearly evident transverse sulcus, which, however, does not reach the dorsum; short, usually spaced carinulae of the immediate cephalic and caudal areas of the lobes indicated to a variable extent. Exposed portion of mesonotum very narrow, strongly transverse, of metanotum longer but also strongly transverse, caudal margins of both subtruncate, surface with rugae series of varying emphasis and extent.

Abdomen with medio-longitudinal carina indicated to the base of the supra-anal plate, less definite or complete continuations of the supplementary carinae of the lateral lobes of the pronotum present to a variable degree laterad on the abdominal tergites, with the surface between bearing numerous short regularly or irregularly disposed rugae of variable emphasis, most marked near the caudal margins of the respective tergites. Supra-anal plate in both sexes transversely divided in two, distal portion trigonal, its surface not sulcate, proximal portion transverse, deeply inset into a broad emargination of the preceding tergite, this portion medio-longitudinally sulcate. Cerci in

both sexes very short, stout, conical. Subgenital plate of male compressed, slightly recurved, subrostrate, apex acute-angulate when seen in caudal aspect, in profile with the dorso-distal point subrectangulate, distal margin in same view straight, definitely carinate. Ovipositor valves short, stout, dorsal ones quite deep, margins entire and untoothed, apices briefly recurved. Subgenital plate of female with distal margin as a whole obtuse-angulate, the immediate angle briefly and sharply acute-lanceolate produced between the valve bases. Prosternum with a low transverse rounded ridge, in no way lamellate or definitely truncate. Mesosternal interspace very short and strongly transverse, one and one-half (♂) or two and one-half (♀) times as broad as one of the mesosternal lobes; metasternal foveolae but narrowly separated in the male, and by half the width of the mesosternal interspace in the female.

Cephalic and median limbs short and stout, in the male more inflated than in the female, the tibiae subcompressed, the femora moderately carinate, notably in the female. Caudal femora moderately compressed, margins entire, dorsal outline, as seen in profile, subconcave in distal half, ventro-lateral carinae sublamellately arcuate, thus giving the whole femora a bent fascies, external pagina definitely patterned, this regular but not deep; caudal tibiae with 8 to 10 external and 10 to 12 internal spines,[58] internal distal spurs subequal in length; tarsal claws equal in length, arolium well developed.

GENOTYPE: *Phrynotettix peruviana* Saussure.

This genus, as known to me, contains but a single species found only in Peru, and there very probably restricted to the high puna country.

Punacris peruviana (Saussure)

(Text-figs. 8, 9, 21 & 22; pl. V, fig. 16, pl. VIII, figs. 25, 26 & 27.)

1888. *Phr*[*ynotettix*] *peruviana* Saussure, Mém. Soc. Phys. Hist. Nat. Genève, xxx, p. 29, pl. 2, figs. 8, 8a, 8b. [♂, ♀; Peru.]

PERU: Oroya, Department of Junin, elevation 12000 feet; VI, 14, 1920; (Cornell University Expedition); 2 ♂, 4 ♀; [Cornell Univ. and A.N.S.P.]: elevation 12178 feet; VI, 20, 1914; (H. S. Parish); 1 ♀; [A.N.S.P.].

While the present series shows a few features of disagreement with Saussure's description, I feel these are due to individual or regional, and hence in the latter case geographic, variation. Again all of the material before me except the single female collected by Parish, has been dried from wet preservation, and in consequence certain differences noticed may be due to shrivelling and correlated

[58] Saussure gives 8 and 7 as the tibial spine series formula of *peruviana*, but the series here referred to that species shows the range given above. It is probable the whole range should include Saussure's lower figures, although several of the very short, more proximal spines may have been overlooked when his count was made. See discussion under *P. peruviana*.

distortion. The measurements given by Saussure and those of the present material are, in millimeters, as follows:

	Length of body	Length of pronotum	Greatest width of pronotum	Length of caudal femur
♂, Peru, *ex Saussure*	14	—	—	6.5
♂, Oroya, Peru	10.2	2.44	3.74	6.3
♂, Oroya, Peru	13	2.60	3.74	6.5
♀, Peru, *ex Saussure*	20	—	—	7.5
♀, Oroya, Peru	14	2.93	4.56	6.5
♀, Oroya, Peru	17.1	2.77	5	6.1
♀, Oroya, Peru	15.1	3.09	4.89	—
♀, Oroya, Peru	14.6	2.60	4.56	—
♀, Oroya, Peru	18.5	2.93	4.72	6.5

The last measured female is that taken by Parish which has never been immersed in liquid preservative, hence has been less subject to contraction. Whether the Oroya specimens are from a higher, more rigorous and less favorable environment than that from which came Saussure's original material, and consequently are smaller, only the future can determine.

All of the present series have 8 articles on preserved antennae except that one antenna of one male has 9, although its mate has but eight. The number of caudal tibial spines in individuals of the present series retaining caudal limbs is found to be 8 to 10 on the external and 10 to 12 on the internal margins, as against 8 and 7 respectively given by Saussure. It is quite possible Saussure overlooked the very short proximal members of the series, or the spines in this species may vary within the limits of 8 to 10 on the external and 7 to 12 on the internal margins.

There is present in the series a wide range of variation in the strength of all surface sculpture of the thorax and abdomen. In one male all the supplementary carinae and rugae mentioned in the generic description are present, in the other only the medio-longitudinal one, the lateral ones of the pronotal disk and that on the lateral lobes are prominent, with the major lateral one on the abdominal tergites less prominent but evident, the subsidiary sculpture almost lacking. In the females we see almost as marked a sculptural range, although none of these have as sweeping a suppression of the subsidiary sculpture as in the smoother male. Curiously in the more heavily rugulose females the accessory

carinae on the lateral lobes of the pronotum are much less evident than in the others, these being virtually absent from the markedly rugulose individual collected by Parish, which has always been a dry preparation.

The striking blackish pattern of the ventral surface described by Saussure is marked in all of these specimens, regardless of their method of preservation.

Further information on the exact area of distribution of this species is awaited with interest. The genus and species is the only one of the group known to me from Andean puna or paramo conditions north of Chile. Additional evidence may show it has a much broader areal range, and may even indicate it is not limited to the Paramo Life Zone.

INCACRIS [59] new genus

This strikingly distinct genus is more nearly related to the two genera which immediately follow it in the present arrangement, i.e. *Crites* and *Paracrites,* than it is to *Punacris* or the others which here precede it. The general form is nearer that of *Crites* than it is to what is found in the other entities, but the broader and less produced fastigium, the sharply defined lateral foveolae of the vertex, the larger number of antennal articles and the much lower and non-lamellate prosternal production will at once distinguish *Incacris* from *Crites.* In most body proportions, and in the emphasis of sculptural features, *Incacris* represents a definite passage from *Punacris* to the generic units which follow.

Generic features.—Form definitely compressed in both sexes, the abdominal dorsum sharply tectate, the venter deplanate, as seen from dorsum the general outline is elongate fusiform. Apterous. Surface of all but venter rugulosotuberculate, with a longitudinal serial distribution of many of the tubercles. Head relatively narrow, width across eyes and genae subequal; eyes but moderately prominent, subtrigonal in basal outline; fastigium in profile appreciably broad rostrate, immediate fastigio-facial angle rounded subacute, facial line obliquely retreating thence to median ocellus, line ventrad of latter as seen in profile less strongly retreating (♂) or subvertical (♀); lateral foveolae of vertex marked, transversely rectangulate, definitely subfastigial in position and facing somewhat ventrad, surface of foveolae moderately excavate, margins marked; outline of fastigium as seen from dorsum slightly acute-angulate, surface slightly broader than long in both sexes, medio-

[59] From Inca, *the dominant Peruvian people at the time of the Spanish conquest,* and *'ακρις, a locust.*

longitudinal carina finely indicated on occiput but not continued upon fastigium, juxta-ocular carinae indicated only by tubercle series; frontal costa very narrow throughout, linearly sulcate, margins subconfluent briefly ventrad of median ocellus, moderately diverging thence ventrad to the clypeal suture. Antennae slightly deplanate, articles usually 10, rarely 9 or 11, distal one subequal in length to the two preceding one together.

Pronotum as seen from dorsum narrowly trapezoidal in outline, greatest caudal width (over all) approximately one and one-fourth times the median length, cephalic margin of disk subtruncate, caudal margin faintly angular-concave as seen from dorsum; median carina continuously marked but not high, lateral or accessory carinae of disk distinct on cephalic two-thirds, on caudal third indicated by low but evident surface swellings, subsinuately and moderately converging caudad to the middle, while in caudal half their intimations markedly diverge to the poorly impressed transverse sulcus, but usually no continuous lateral carinae are here apparent, and usually no intimations of these reach the caudal margin,[60] median separation of lateral carina subequal to half width of cephalic margin of disk; lateral lobes deeper than broad, more nearly quadrate in the male than in the female, cephalic margin definitely sinuate, ventral very strongly so, the whole appreciably narrowing ventrad, surface with trace of median low tuberculiferous elevation, which is longitudinal caudad and declivent cephalad, caudal margin of lobes with regularly placed blackish sublinear node-like tubercles.

Mesonotum, metanotum and abdominal tergites distad to those immediately preceding the supra-anal plate with a definite medio-longitudinal carina, segmental margins of dorsal part of lateral aspects of abdomen with numerous, regularly placed, polished, blackish nodes similar to but smaller than those on caudal margin of lateral lobes of pronotum, median and more ventral parts of lateral aspect of abdomen solidly shining blackish-fuscous in the male, less polished and often not distinctively colored in the female. Supra-anal plate in both sexes divided in two transversely, distal portion trigonal, proximal section with a distinct medio-longitudinal concavity. Cerci in both sexes short, conical, acute. Subgenital plate of male broad at base, compressed distad, disto-ventral surface carinate, in profile the dorso-distal angle is subacute. Ovipositor valves of female moderately compressed, margins untoothed, distal points briefly recurved. Subgenital plate of female with distal margin as a whole obtuse-angulate, the immediate median angle acutely produced between bases of ventral ovipositor valves. Prosternum with cephalic margin transversely lamellato-carinate, this mesad developed into a very low and broad, rounded trigonal production. Interspace between mesosternal lobes strongly transverse, its width slightly greater than that of one of the lobes, internal lobar margins broadly arcuate; metasternal foveolae subcontiguous in the male, separated by not more than a third the width of the mesosternal interspace in the female.

[60] In certain individuals of *I. phaenogaster* these are continued to the caudal margin, but are broken by the transverse sulcus. Usually, however, the carinal indications are absent caudad.

Cephalic and median limbs relatively short, moderately robust in the male sex; caudal femora moderately stout, little compressed, dorsal carinae sparsely tuberculoid serrato-dentate, ventro-external carina sublamellate-arcuate, external pagina moderately impressed in a chevron pattern; caudal tibiae usually with 7 external and 8 internal spines (rarely 6 or 8 external and 9 internal), internal distal spurs subequal in length; tarsal claws equal in length, arolium well developed.

GENOTYPE: *Incacris phaenogaster* new species.

But a single species of *Incacris* is known to me, this being an inhabitant of the Andean uplift in Peru, where it is known to range as high as 2600 meters (8500 feet).

With *Crites* and *Paracrites* this genus forms a subgroup of the Tristirae which apparently has gone through much of its evolution in Peru, where to-day these genera occur in areas within the Subtropical Life Zone and perhaps even the higher Tropical. The genus *Punacris* is apparently another phylum which similarly has developed in the Peruvian region. Just when these elements were differentiated from the ancestral lines of those others making up the group cannot of course be ascertained, but clearly this took place well before the Pleistocene and probably even before the Pliocene. This time lapse can certainly be assumed from the amount of morphological differentiation which has taken place since the onset of this generic segregation.

Incacris phaenogaster[61] new species (Text-figs. 10, 11, 23, 24 & 25; pl. III, fig. 3, pl. VIII, figs. 28, 29 & 30.)

Type.—♀; Conchamarca, Department of Huanuco, Peru.[62] Approximate elevation 2600 meters. November 5, 1937. (Felix Woytkowski.) [Academy of Natural Sciences of Philadelphia, Type no. 5670.]

Size relatively small (for group); surface subpustulate through the broad distribution of many small tubercles and rugulae, which in general have a fair regularity of pattern distribution.

Head with exposed dorsal length but slightly less than median length of pronotal dorsum, the former subequal to the width across the eyes, surface of occiput slightly ascending cephalad, inter-ocular width equal to half of breadth across eyes; length of fastigium cephalad of cephalic points of eyes equal to little more than one-half the proximal width of fastigium, which

[61] From *φάεινος, shining,* and *γαστήρ, belly.*

[62] This locality, according to Stiglich (Diccionario Geográfico del Perú, 1922), is in the province and district of Ambo, on the slopes of a mountain ridge, and distant three and one-half leagues from the departmental capital of Huanuco, and two and one-half leagues from the town of Ambo.

is very briefly cephalad of the cephalic point of the eye, the converging, slightly acute, carinate cephalic margins of the fastigium individually very slightly arcuate, juxta-ocular carinulae low, subparallel, fusing cephalad with the cephalic margins of the fastigium, between the eyes is placed a pair of short, caudad converging but well separated and sinuous carinae of uneven elevation emphasis; lateral foveolae of vertex with dorsal margin, which is also the fastigial border, moderately arcuate dorsad as seen in lateral aspect and somewhat overhanging, ventral margin more strongly arcuate than dorsal one, greatest (caudal) depth of foveola equal to one-half its length; frontal costa with the inter-foveolar section rostrately lamellato-compressed and non-sulcate, the thence indicated carinately elevated lateral margins uneven in curvature and emphasis dorsad of the median ocellus. Lateral (accessory) facial carinae distinct but low, moderately concave divergent ventrad: eyes with greatest breadth of basal outline equal to four-fifths of the greatest depth of same, this latter contained one and one-third times in the length of the infra-ocular sulcus. Antennae in length subequal to depth of head, composed of ten articles, the elongate distal one faintly broader than those preceding.

Pronotum as a whole markedly tectate except for the subdeplanation of the relatively narrow disk; cephalic margin of disk subequal to half the median length of the same; accessory (lateral) carinae of the disk as described under genus, their termination at the transverse sulcus relatively abrupt; median carina of pronotum continuous but uneven in elevation and degree of emphasis; subcompression of pronotum through the dorsal portion of the lateral lobes very definite, particularly cephalad: lateral lobes with principal transverse sulcus subobsolete except for the brief dorsal section, preceding transverse sulcus intersecting the oblique ridge of the lobes and indicated ventrad of same but obsolete dorsad. Mesonotum, metanotum and dorsal portion of the abdominal tergites with the tectate form and its median carina marked, the carina having each tergal section individually subarcuate as seen in profile, more lateral surfaces with the longitudinal (primary) and transverse (secondary) arrangement of tubercles pronounced, the mesolateral polished blackish fuscous area distinct on the second, third and fourth tergites.

Prosternum with the ventro-cephalic border of the subinflated intercoxal area carinate transversely, seen in cephalic aspect arcuate with a low subtrigonal median tubercle, this but little elevated above the more caudal surface, cephalic face obliquely deplanate. Surface of meso- and metasterna and venter of abdomen definitely polished with a few sparse hairs.

Supra-anal plate with distal half elongate-acute trigonal, its median length equal to one and two-fifths times the proximal width of that half, in profile slightly decurving distad; proximal half of plate with areas laterad of the carinae bordering the median sulcation broadly subexcavate. Cerci subattenuate distad of the relatively robust bases, total length less than twice the proximal breadth. Ovipositor jaws moderately deep, the brief distal uncination of the dorsal pair shorter and more abrupt than that of the ventral ones,

dorsal surface of the dorsal valves appreciably concave within the lateral margins, lateral plates of ventral valves acute lanceolate. Subgenital plate with ventral surface subdeplanate distad.

Cephalic and median femora with the carinae well marked and bearing numerous low strumose nodes; cephalic and median tibiae appreciably compressed. Caudal femora with greatest median depth contained three and three-tenths times in their length, least pregenicular depth distinctly less than half the greatest femoral depth (as 22 to 50), dorsal outline in profile faintly concave from point of greatest depth distad to genicular arch, dorso-lateral carina of pagina with sparse tuberculoid serrato-dentations as on the median carina, each with intercalated nodules of a similar but minor category, pattern of pagina regular and evident but similarly accentuated by superimposed tubercles, genicular lobes with distal angle rounded rectangulate; caudal tibiae with 7 external and 8 internal spines.

Allotype.—♂; same data as type. [Academy of Natural Sciences of Philadelphia.]

Differing from the above description of the female type in the following noteworthy respects.

Size very small (for group); general form and surface sculpture as in female.

Head with greatest width across eyes equal to one and a fourth times the exposed dorsal length of the head, interocular width equal to half the dorsal length of head and appreciably less than half the breadth across eyes; angle of fastigium, when seen from dorsum, as in female, the individual cephalic margins of the same virtually straight convergent: eyes appreciably more prominent than in female, basal outline more ovoid but with relative proportions as in female, the length of the infra-ocular sulcus, however, being equal to not over three-fourths the greatest depth of the eye. Antennae more elongate than in female, slightly longer than depth of head, structure as in female.

Pronotum with its general features showing only very minor differences from the description of this portion of the body in the female type; accessory (lateral) carinae of disk less definitely terminated at the transverse sulcus, their continuations toward the caudal margin more evident even if irregular; median carina of pronotum slightly more uniform than in female.

Abdomen with the glabrous blackish fuscous area strongly and solidly marked meso-laterad on the first to fifth tergites.

Prosternum with its median development somewhat more pronounced and definitely obtuse-angulate transversely than in the female.

Supra-anal plate and cerci with their details as in female. Subgenital plate relatively short and broad, the recurvature of the compressed apex so definite that the carinate median line of the ventro-caudal surface of the plate faces dorso-caudad, apex in profile rectangulate, converging dorso-lateral margins slightly arcuate as seen in profile.

Compression of cephalic and median tibiae more marked than in female, the correlated expansion more definite. Caudal femora with their apices surpassing that of the abdomen by approximately half the length of the pronotal disk, greatest median depth contained three and one-seventh times in their length, least pregenicular depth not more than one-third the greatest femoral depth (as 15 to 45), details of the caudal femora as in the female except that the carinal serrato-dentations are smaller and less elevated, and the ventro-lateral carina is more sublamellate and arcuate.

Coloration.—Base color ranging from as pale as buffy brown to as dark as mummy brown, in the latter case relatively solid, in one female as ruddy as ochraceous-tawny, the dorsal and lateral surfaces in all but the very dark and intensively colored individuals clouded and punctate with mummy brown, the elevated surface tubercles often glabrous and shining to a variable degree, and in consequence quite conspicuous. There is little uniformity in the block patterning of the paler and darker dorsal and lateral areas, except that the conspicuous broad lateral glabrous blackish fuscous areas on the abdomen, which have been described above under structure, are uniformly indicated in all the males seen, while in the females these may be indicated in the reduced condition described above in the type, or may range in decreasing extent and conspicuousness to an opposite extreme where they are completely absent; the type is the sole female seen with the lateral abdominal marking so extensive, and from this, in that sex, it reduces progressively by breaking up into a few individual segmental areas and finally to complete elimination. The single immature female seen, however, shows indications of this dark glabrous pattern on at least two tergites. Two of the available males show broad pale bars on each side of the face, descending obliquely from the postocular part of the head to the lateral portions of the clypeus; in the other males no traces of these head bars are evident, although in both those with and those without the pale head bars indications of two (or even three) poorly defined pale bars, directed ventro-cephalad, can be detected on the lateral lobes of the pronotum. The antennae are of the general color mottled with fuscous; eyes ranging from buckthorn brown to cinnamon-brown, occasionally crossed diagonally by a narrow pale ochraceous line on the ventral half. Limbs as a whole of the general mottled tones, the caudal femora of the males usually with one or two oblique, ventro-proximad directed pale bars; while these are evident in the single immature female all the adults of that sex either lack them entirely or show only the most rudimentary traces; internal face of caudal femora broadly fuscous, usually with a narrow pale pregenicular area, ventral surface generally fuscous with a similar pregenicular pale area, but sometimes not as deeply infuscate as the internal, although always dark, ventro-external carina rarely (allotype only) lined with ochraceous-orange. Caudal tibiae scarlet to brazil red in the males, duller in the females and nearer morocco red to brick red, the tibiae in the latter sex becoming definitely infuscate proximad, tibial spines black tipped. Ventral surface of meso- and metasterna, and nearly all of abdominal venter (except immediate apex) orange rufous (in pale females) to brazil red.

The wide range of base tonal depth and the intensity and corresponding extent of the dark overlying pattern, with a correlated diminution or strengthening of the color tone of the red areas produces a very different appearance in the extremes.

Measurements (in millimeters)

	Length of body	Length of pronotum	Greatest breadth of pronotum	Length of caudal femur
♂, Conchamarca, *allotype*	13	2.44	3.6	7.5
♂, Conchamarca, *paratype*	12.8	2.28	3.4	7.5
♂, Conchamarca, *paratype*	11.5	2.28	2.9	6.3
♂, Conchamarca, *paratype*	11	1.95	2.6	5.7
♀, Conchamarca, *type*	19.4	3.09	4.4	8.6
♀, Conchamarca, *paratype*	17.4	3.26	4.4	8.6
♀, Conchamarca, *paratype*	17.9	2.93	4.2	8.1
♀, Conchamarca, *paratype*	17.6	2.93	4.2	8.4
♀, Conchamarca, *paratype*	16.3	2.93	4.5	8.1
♀, Huacapistana, *paratype*	17.2	2.93	4.2	8.6

Variation.—The size range of the available series is shown by the above complete series of measurements of the adults, while the color range is covered by the remarks made under that heading. It should be emphasized that the whole color range noted is found in the series from the type locality, and therefore no single element of this can be ascribed to regional or altitudinal factors. The extent of this purely individual variation is the same as that frequently noted in similar geophilous non-alate forms. That certain tendencies of the coloration may have a genetic explanation can only be suggested.

As with numerous other geophilous species with a tuberculiferous integument we find a very considerable amount of variation in the degree of emphasis of tubercles, and the completeness or degree of accentuation of carinae, which may even be reduced to mere series of similarly disposed tubercles, retaining a structural mode or pattern although lacking in strength. One of the paratypic males has the angle of the fastigium, as seen from the dorsum, very much more acute than in the allotype, while one of the female paratypes has the same angle so much broader than in the type that it can very definitely be called obtuse-angulate. The degree of fastigial angulation in the majority of the individuals seen is, however, as described from the respective sexes.

The number of antennal articles is 10 in all the four males seen, and 9 (in one antenna of one, the mate having 10) to 11 (in two specimens) in the females, with 10 present in one or both antennae of five of the seven of that sex available. One male and three females lack one antenna. The number of caudal tibial spines averages 7 external (two with 6 on one limb, and one with 8 on a single limb) and 8 internal (two with 9 on both tibiae and one with 8 on one limb and 9 on the other).

Specimens examined.—In addition to the type and allotype I have before me from the Academy collections three adult males, five adult females and one immature female bearing the same data as the type except that the dates extend from the 5th to the 20th of November, 1937. I have also seen one adult female taken at Huacapistana, Rio Tarma, Department of Junin, Peru,[63] June 1–3, 1920, by the Cornell University Expedition, and from the collection of that university. All these adults I am considering paratypes.

Remarks.—This species, and as far as known the genus, occurs at elevations between 6000 (town of Huacapistana) and 8500 (Conchamarca) feet, although the former elevation may be too low, as in the immediate vicinity of Huacapistana the slopes go sharply upward to 8000 feet, and we have no exact elevation information for the single specimen from that point. It would thus appear that *Incacris phaenogaster* is, as far as known, an inhabitant of the Subtropical Life Zone in Peru. Under certain conditions in Peru, however, 8500 feet may be sufficiently high to carry Temperate Life Zone environments.

CRITES[64] new genus

This striking genus has its nearest relative in *Paracrites,* described on a following page, while in a linear arrangement *Incacris* is clearly the nearest, but more distant, ally in the opposite direction. The preceding key to genera gives some of the more evident features distinguishing *Crites* from these relatives. The fastigial

[63] Stiglich in his "Diccionario Geográfico del Perú" (1922) gives Huacapistana as in the District of San Ramon, on the road from Chanchamayo to Pichis, and distant 8 leagues from Tarma and 7 from La Merced.

[64] From *κρίτης, a discerner or interpreter,* in allusion to the interpretive value of the features of this genus in understanding the relationship of the various genera of the Tristirae.

form indicates a beginning of the elongate rostrate type culminating in *Tropidostethus,* while the quite similar pronotal form is even more indicative of close relationship with *Paracrites.* However, we find in these two genera a marked difference in the development of the lateral foveolae of the vertex, these being obsolete in *Crites,* while fully developed and clearly defined in *Paracrites.* The deeper body and compressed caudal femora of *Crites* will also readily distinguish this genus from *Incacris,* together with the quite different surface texture, while the whole form is definitely stockier yet with more slender cephalic limbs than in *Paracrites.*

Generic features.—Form robust, definitely compressed, deep, fusiform in outline as seen from dorsum. Apterous. Surface as a whole shagreenous, in addition areally with numerous low but distinct subasperous tubercles, proximo-lateral faces of abdomen of male mesad glabrous blackish fuscous, medio-longitudinal carina indicated dorsad from fastigium to penultimate abdominal tergite, surface of venter largely polished over cribrosely impressed punctations. Head with width across eyes but little less than that across genae in male, equal to seven-eighths same in female; fastigium as seen from dorsum trigonal with its converging margins narrowly rounding to the subacute apex,[65] dorsal surface of fastigium weakly concavo-excavate proximad on each side of the median carina, shagreenous character of fastigial and occipital surface marked; fastigio-facial area in profile subrostrate, short truncate cephalad, dorsad forming an obtuse angle with the fastigial borders, which are distinctly arcuate in this view, facial line meeting the truncate rostral line at an obtuse angle, and ventro-caudad obliquely retreating to the vicinity of the median ocellus, thence ventrad subvertical (♀) or slightly oblique (♂) to the clypeal suture; lateral foveolae of vertex obsolete, this area definitely concavo-excavate and without ventral delimiting carina; frontal costa marked, a simple lamellato-carinate ridge at the rostral extremity, immediately ventrad of which the carinate margins arcuately open to form a subfossulate area, then converge and continue subparallel and closely placed to the vicinity of the median ocellus where they may, or may not, weakly expand again, briefly converge and then finally evenly diverge toward the clypeal suture, where they are widely separated, sulcation of costa indicated throughout except on the unicarinate section; lateral (accessory) facial carinae definite but rather low, diverging ventrad, irregularly emphasized and sparsely nodiferous. Eyes not protuberant, in basal outline ovoid-trigonal, the dorso-cephalic angle sharply acute in the female. Antennae in length not exceeding depth of head, appreciably deplanate distad of third of the eight articles, the distal one slightly longer than either of the two preceding but shorter than these two combined.

[65] A single female of the four specimens seen has these margins almost straight convergent to the immediate apex, but this is not true of the other three specimens.

Pronotum with its depth in profile appreciably greater than its medio-dorsal length, as seen from dorsum its outline is narrowly trapezoidal, in cross section the tectation of the dorsum is pronounced; cephalic margin of the narrow area which may be called the disk moderately arcuate, caudal margin dorsad broadly and obtusely emarginate with a narrow median, more sharply indicated accentuation; medio-longitudinal carina evenly marked, cut only at caudal fourth and there by the shallow but definite principal sulcus; accessory (or lateral) shoulders of what may be called the discal area of the pronotum non-carinate, low strumose, closely subparalleling the median carina and becoming obsolete when the principal sulcus is reached, ventrad of these low shoulders the surface of the lateral lobes is subimpressed, producing a "pinched" appearance: lateral lobes of the pronotum deeper than long, moderately narrowing ventrad, cephalic margin sigmoid, ventral margin concavely emarginate cephalad, truncate caudad, caudal margin sinuate, principal transverse sulcus subobsolete on lateral lobes, a short median and an intermarginal cephalic one indicated in the same areas. Mesonotum and metanotum in transverse section showing a definite passage to the very sharply tectate dorsum of the abdomen, the median carina on the nota, and less definitely on the more proximal abdominal tergites, very narrowly accompanied on each side by a parallel series of small tuberculiform asperities, between which lies the smoothly polished carina; exposed length of mesonotum equal to three-fifths that of metanotum, caudal margin of former very bluntly obtuse-produced caudad, of latter with the same tendency subobsoletely indicated.

More distal tergites of abdomen in both sexes strongly infolded and telescoped mesad, exposing the strongly reëntrant base of the supra-anal plate, latter in both sexes with the distal part acute trigonal, slightly decurving distad in profile, median transverse division pronounced, proximal half with a distinct medio-longitudinal sulcus. Cerci in both sexes simple, short, conical proximad, attenuately tapering distad. Subgenital plate of male short, stout, moderately recurved, appreciably compressed distad, disto-dorsal angle in profile subrectangulate, dorsal margin arcuate, subvertical distal margin straight, carinate, the carination dividing proximo-ventrad. Ovipositor jaws stout, compressed, dorsal pair quite deep, relatively blunt apices hardly falcate as seen in profile, dorso-external margins of dorsal pair irregularly and shallowly but appreciably crenulato-serrulate, dorsal surface of dorsal valves definitely concave, ventral valves with lateral plates acute lanceolate. Subgenital plate of female with distal margin obtusely produced, mesad a thin vertical lamellate production extends subvertically between the ventral ovipositor valves. Prosternal production transverse, lamellate, in outline low obtuse-angulate in the female, subrectangulate in the male, immediate angle of same narrowly rounded, cephalic face deplanate, caudal face concave. Interspace between mesosternal lobes strongly transverse, caudal margin of lobes obliquely subtruncate; metasternal foveolae separated by less than one-third the width of the mesosternal interspace.

Cephalic and median limbs relatively slender, particularly in the female, carination of femora apparent. Caudal femora quite definitely compressed,

robust, greatest median depth contained but slightly more than three (♂) or three and two-fifths (♀) times in their length, least pregenicular depth equal to about half the greatest femoral depth, medio-dorsal carina spaced serrulate, dorsal surface with numerous scattered low tubercles, paginal pattern with regular chevron-shaped elements, genicular lobes subacute at apices; caudal tibiae with 7 external spines, none in the usual position of an apical spine, internal margin with 7 or 8 spines, one (in the case of 7 present) or two (in the case of 8 present) between the normal distal one and the remainder of the more proximal usual length members of the series very much smaller than the others; tarsal claws equal in length, arolium well developed.

GENOTYPE: *C. prestoni* new species.

The two genera *Crites* and *Paracrites* show relatively the same degree of relationship as that associating *Moluchacris* and *Peplacris,* and the two represent a line of the Tristirae which has gone through most, if not all, of its evolution in the Peruvian area. The information at hand is too scanty to warrant any broader assumption as to the evolutionary history of these closely related but quite distinct genera.

Crites prestoni[66] new species

(Text-figs. 12, 13, & 26; pl. III, figs. 4, 5 & 6, pl. IV, fig. 9.)

Type.—♀; Leonpampa, 110 kilometers east of Huanuco, Peru.[67] "Tropical jungle." December, 1937. (Felix Woytkowski.) [Academy of Natural Sciences of Philadelphia, Type no. 5671.]

Size medium (for group); thorax and abdomen as a whole definitely tectate, particularly latter, venter deplanate.

Head as seen from dorsum subconic, the prominence of the eyes not sufficiently strong to break materially this general appearance, as seen in cephalic aspect the greatest width across genae is equal to one and one-fourth times that across eyes and to two-thirds the total depth of the head; fastigium as

[66] In memory of the late Dr. B. Preston Clark, of Boston, Massachusetts, to whose generosity the Academy is indebted for the series of Orthoptera containing this species, as well as other important and valuable collections of that order and representations of many species in his special field of study, the Sphingidae.

[67] I have been unable to place this locality on any chart or in any gazeteer which I have examined. It is probably a very recent settlement in forest country, perhaps as low as the truly Tropical Life Zone. One could conclude, from the distance given, that it is in the valley of the Rio Patchitea tributary of the Ucayali, but on the 1932 chart of Peru prepared by the Sociedad Geográfico de Lima the trail indicated to the eastward of Huanuco, after bearing east for perhaps sixty kilometers, swings northward down the valley of the Rio Huallaga toward the settlement of Tingo Maria. A high divide here, and everywhere else in this general region, separates the two drainages. It is therefore probable that Leonpampa is in this headwaters region of the Rio Huallaga.

seen from dorsum with greatest proximal width of same at cephalic point of eye equal to one and three-tenths times the median length of the fastigium caudad to the same axis, the converging cephalic margins slightly arcuate, the immediate angle acute,[68] median carina while clearly marked on the occiput becoming less marked and poorly defined as the extremity of the fastigium is reached; fastigio-facial angle, facial line and frontal costa described under genus; lateral foveolae of vertex obsolete, these areas concavely passing into those of the antennal fossae without an intervening ventral foveolar margin. Eyes with greatest width of basal outline equal to one and one-half times the greatest depth, length of infra-ocular sulcus equal to eye depth.

Pronotum with greatest caudal width across lateral lobes equal to two-thirds of median length, in profile the dorsal outline is low arcuate cephalad, virtually straight caudad; cephalic margin of disk arcuately extending cephalad over base of occiput, caudal margin of disk with the median obtuse-angulate emargination distinct but not deep; median carina distinctly carinate, severed only by principal sulcus, which is at caudal fourth; low strumose non-carinate analogs of the lateral discal carinae unevenly sinuate, twice as widely separated at cephalic margin as mesad, where they are distant from one another no more than the length of the metazona, i.e. that area meso-caudad of the transverse sulcus, and on which latter division these lateral strumae are absent: lateral lobes with the intramarginal sulcus present in the middle depth and following the general sigmoid pattern of the cephalic margin of the lobes, median sulcus indicated only in ventral half of the lobes; vicinity of the caudal margin of the disk and lobes with spaced brief cariniform ridges as seen in species of related genera. Mesonotum, metanotum and general abdominal features described under genus.

Supra-anal plate deeply inserted in the broadly arcuate and sharply mesad subfissate emargination of the preceding tergite, proximal half of plate nearly twice as broad as median length, the pronounced medio-longitudinal sulcus narrower in most of its length than it is briefly proximad, more lateral surface with numerous asperities which are most emphasized on each side of the sulcus, distal margin of this portion of plate transverse truncate with shorter straight oblique lateral marginal sections, distal portion of plate equilateral, its surface low tuberculate. Cerci reaching to middle of distal portion of supra-anal plate. Ovipositor jaws and subgenital plate described under genus.

Interspace between mesosternal lobes with greatest width nearly equal to twice that of one of the lobes and approximately three and one-half times the depth of the interspace, internal margins of lobes straight, slightly oblique, meso-caudal angle obtuse. Metasternal foveolae separated by a distance less than one-third the width of the mesosternal interspace.

[68] In the type the converging cephalic margins are nearly straight, the median angle definitely acute; in the single paratypic female the margins are very clearly arcuate convergent, the juncture rounded rectangulate. Individual variation within this species is thus an important factor in modifying certain features.

Caudal femora stout, briefly surpassing the apex of the abdomen, subtriquetrous in transverse section, subdeplanation of the lateral face evident, ventral sulcus broad and relatively deep, dorsal outline moderately arcuate, ventral margin more strongly so, ventro-lateral area relatively narrow, shallowly channelled: caudal tibiae with seven external and eight internal spines, extensor surface subsulcate distad.

Allotype.—♂; same data as type. [Academy of Natural Sciences of Philadelphia.]

Differing from the description of the female type in the following noteworthy respects.

Size somewhat smaller; form less fusiform as seen from the dorsum, the abdomen not tapering distad and its caudal extremity relatively blunt.

As seen from dorsum the eyes are somewhat more prominent than in the female, more definitely breaking the subconic outline of the head, width across genae but very slightly greater than that across eyes, the genal breadth equal to three-fifths the total depth of the head; fastigium as seen from dorsum with greatest proximal width of same at cephalic point of eye equal to one and one-fourth times the median length of the fastigium cephalad of the same eye point, details of fastigium as in female; head in profile as in female except that facial line ventrad of median ocellus is more obliquely retreating; eye outline faintly broader than in female, greatest width of same contained one and three-eighths times in greatest depth.

Pronotum, mesonotum and metanotum as in female. Median carina of abdomen, where present, more distinctly arcuate individually than in female.

Supra-anal plate as in female. Cerci similar in structure to those of female but slightly more attenuate distad and reaching to distal third of distal portion of supra-anal plate. Subgenital plate described under genus.

Caudal femora reaching to apex of abdomen, similar to those of female in proportions and carinal development, lateral face with subdeplanation less evident; caudal tibiae with 7 spines on each margin, dorsal surface subsulcate as in female.

Coloration.—As a whole dull mummy brown, very obscurely mottled with cinnamon-brown or dresden brown, one female with the base color as much dresden brown as mummy brown and the head largely bister, which is not the case with the other specimens seen. Glabrous areas on sides of proximal portion of male abdomen shining blackish fuscous. Eyes olive-brown to buffy brown. Antennae of the general tone. Cephalic and median limbs and external face of caudal femora inconspicuously mottled, internal and ventral faces of caudal femora blackish; caudal tibiae largely dull brick red or madder brown, passing to general color proximad, spines black tipped. Ventral surface subglabrous and ranging from mummy brown with a median group of subtriangular maculae of dull ochraceous-tawny, one on each abdominal sternite, and these flanked laterad by blackish fuscous (males only), to mottled on both sterna and sternites with hazel (females only). Subgenital

plate of male conspicuously marked on distal surface with shining blackish fuscous.

Measurements (in millimeters)

	Length of body	Length of pronotum	Greatest caudal width of pronotum	Length of caudal femur
♂, *allotype*	20.5	3.58	5.2	9.9
♂, *paratype*	19.3	3.58	5	9.1
♀, *type*	24.1	4.56	7.3	11.7
♀, *paratype*	26.5	4.72	6.5	12.2

Paratypes.—In addition to the type and allotype I have before me, in the collection of the Academy, one male and one female taken with the typical material, and these are considered paratypes.

Variation.—But two variational features seem worthy of note. One is the difference in exact shape, as seen from the dorsum in the fastigial outline of the two females examined. From the basis of the two males I consider that the more acute outline seen in one of the females, i.e. that selected as type on account of its otherwise more perfect preservation, is aberrant, and that the shape seen in the other three is the more normal condition for the species, and incidentally the genus. The unusual arrangement of the spines distad on the internal margin of the caudal tibiae also shows some variation. All four individuals have the distal one of this spine series large, and in all but the allotypic male between this spine and the next one proximad of the same length category are placed two definitely shorter and more closely placed spines; in the allotype there is but one spine of the minor scale.

Distribution.—While it is impossible to say in what life zone *Crites prestoni* occurs, as we do not have, and are unable to secure, any information on the elevation of Leopampa, it is certain that this genus and *Paracrites* occur in more nearly tropical conditions than any of the other members of the group. The type locality of the single species of *Paracrites* (San Nicolas to kilometers 71, Pichis Trail, Peru) is at an elevation of 4000 to 6000 feet, where conditions are in all probability Subtropical. If *Crites* occurs at a definitely lower level than this, it lives in the Tropical Zone, and therefore would be the only known member of the Tristirae from that life area.

PARACRITES[69] new genus

The nearest relative of this genus is *Crites,* as has been stated under the diagnosis of the latter, and the chief differential features already have been presented in the key to the genera and in the discussion under *Crites.* The characters of the female sex of *Paracrites* are not known, but doubtless will include additional features of service in the segregation of the two genera.

Generic features.—Form strongly compressed, relatively deep, markedly tectate dorsad, thoracic sterna subdeplanate, general outline as seen from dorsum very narrowly acute fusiform. Apterous. Surface of dorsum and lateral aspects with many short rugulae and scattered shagreenous points, these occasionally subasperous tubercles, proximo-lateral faces of abdomen of male (in female ?) glabrous fuscous, venter moderately polished, medio-longitudinal carina of the dorsum indicated from the base of the fastigium to the penultimate abdominal tergite. Head with width across eyes subequal to that across genae in the male (in female ?); fastigium as seen from dorsum elongate subtrigonal, its converging lateral margins in cephalic half appreciably arcuate to the narrowly rounded apex, dorsal surface of fastigium with marked but scattered subasperous tubercles, subconcave mesad, its median carina absent cephalad, interocular region relatively broad, little narrower than proximal width of fastigium, eye margins there subparallel, nearly straight, median carina there and on occiput well marked, flanked laterad by a pair of roughly paralleling and irregularly elevated broken strumose rugae, which extend caudad from paired nodes situated virtually on a line between the cephalic points of the eyes; fastigio-facial angle in profile moderately rostrate, its cephalic outline evenly arcuate, with a slight obtuse-emargination where it joins the more dorsal, straight, strongly oblique portion of the facial outline, this ventrad of the median ocellus less markedly oblique; lateral foveolae of vertex sharply defined, in shape elongate subrectangulate, median vertical depth not more than a third of their length, dorsal margin virtually straight, ventral margin strongly concave, this making the greatest foveolar breadth in the cephalic third, surface of foveolae subexcavate with a single substrumose tubercle indicated cephalad, paired ocelli placed ventro-caudad; frontal costa between foveolae of vertex a mere lamellate ridge, immediately ventrad of this it is narrowly but appreciably sulcate with the bounding margins first narrowly and arcuately but sharply diverging, then converging evenly and gradually and again similarly diverging to briefly dorsad of the median ocellus, thence subparallel ventrad for three-fifths the distance between the ocellus and the clypeal suture, and finally definitely but not sharply diverging toward the latter; lateral (accessory) facial carinae distinct, continuous, faintly nodiferous, evenly diverging ventrad. Eyes moderately prominent, in basal outline ovoid-trigonal, no angles sharply acute (in male). Antennae slightly longer than head is deep, ap-

[69] From παρά, *beside,* and *Crites,* the preceding genus.

preciably deplanate from third to antepenultimate article, number of articles nine, distal one slightly longer than penultimate and antepenultimate articles together.

Pronotum with depth in profile slightly greater than its medio-dorsal length, tectation of dorsum very marked; cephalic margin of discal area narrow, very slightly obtuse-angulate, caudal margin of disk quite broadly and evenly obtuse-angulate emarginate, this evident ventro-laterad as far as one-third the total pronotal depth; median carina distinct, subundulate in profile, severed only by the principal sulcus, this at the caudal fourth; accessory (or lateral) shoulders of discal area low strumose, incompletely carinulate, moderately converging from cephalic margin, where they are separated by a distance equal to one and one-half times the length of the metazona, to slightly cephalad of the middle, where they are distant from one another a space subequal to the metazonal length, and after extending caudad subparallel to the transverse sulcus they become obsolete as definite sculpture, ventrad of these shoulders the surface of the lateral lobes is longitudinally impressed; lateral lobes of pronotum, as delimited ventrad of the accessory shoulders, subquadrate, definitely narrowing ventrad through the sinuate obliquity of the cephalic margin, ventro-cephalic angle sharply obtuse-angulate, ventral margin strongly sinuate, caudal margin convexly subsinuate, ventro-caudal angle broadly rounded, principal transverse sulcus virtually obsolete on the lateral lobes, one definite median transverse sulcus indicated across most of the depth of the lobe, brief submarginal longitudinal cariniform rugae placed subuniformly along the cephalic and caudal margins of the whole pronotum, as in related genera. Structure of mesonotum, metanotum and dorsum of the abdomen of essentially the same character, being sharply tectate, with a well indicated median carina which in profile caudad is progressively more arcuate on each individual tergite, this carina on the mesonotum and metanotum, and more evanescently on the more proximal abdominal tergites, very closely paralleled by a pair of broken, nodulosely indicated carinulae, between which the polished carina itself is cradled; exposed length of mesonotum equal to approximately three-fourths that of the metanotum, caudal margins of both transversely truncate, but faintly and nodularly produced mesad.

Lateral glabrous area of proximal portion of abdomen (in male) delimited dorsad by a structural substrumose but non-carinate ridge, between which and the median ridge the surface is in part at least subconcave. More distal tergites of male abdomen infolded and telescoped mesad, the base of the supra-anal plate definitely reëntrant; supra-anal plate of male as a whole trigonal, divided in two by a transverse incision, distal portion acute trigonal, proximal portion with a deep medio-longitudinal sulcation bounded by nodiferous parallel carinae. Cerci of male simple, short, conical proximad, attenuately tapering distad. Subgenital plate of male short, stout, appreciably compressed dorsad, bulbose ventrad, moderately recurved as seen in profile, disto-dorsal angle in same view rectangulate, and dorsal margin, in same aspect, arcuate, distal margin briefly carinate dorsad. Prosternal production lamellate, broad, rounded trigonal-sublinguiform in outline as seen in cephalic aspect, distinctly elevated as seen in profile, cephalic face deplanate. Inter-

space between mesosternal lobes in male moderately transverse, internal margin of lobes subobliquely arcuate; metasternal foveolae of male contiguous, separated only by a septum.

Cephalic and median limbs relatively stout (for the group), femoral carination marked. Caudal femora of male little compressed, definitely robust, greatest (slightly premedian) depth contained three and one-sixth times in their length, least pregenicular depth subequal to half the greatest depth, medio-dorsal carina with spaced blunt serrations, narrow latero-dorsal surface with a subparallel series of more numerous subserrate tubercles, paginal pattern with regular and chevron-shaped elements, dorsal paginal carina with spaced serrulations, genicular lobes rounded subacute at apices: caudal tibiae with 7 external spines, none in the usual position of an apical spine, internal margin with eight spines of usual arrangement: tarsal claws equal in length, arolium well developed.

GENOTYPE: *Paracrites pichis* new species.

The sole species known occurs in the upper reaches of the Rio Ucayali in eastern Peru.

Paracrites pichis[70] new species
(Text-figs. 14, 27 & 28; pl. IV, fig. 10, pl. VIII, fig. 31.)

Type.—♂; San Nicolas to kilometer 71, Pichis Trail,[71] Department of Junin, Peru. Altitude, 4000–6000 feet. February, 1930. (M. A. Carriker, Jr.) [Academy of Natural Sciences of Philadelphia, Type no. 5672.]

Size relatively small (for group); tectation of thorax and abdomen most pronounced, body compression marked.

Head as seen from dorsum compressed conic, eyes relatively prominent and breaking general outline; occiput and fastigium as seen in profile with their dorsal line nearly level and straight; fastigium as seen from dorsum with greatest proximal width between cephalic points of eyes slightly greater than median length of fastigium from the same point cephalad, lateral fastigial margins virtually straight in their more caudal half, cephalad gently arcuate to the narrowly rounded apex; median carina and fastigial sculpture described under genus; fastigio-facial angle, lateral foveolae of vertex and frontal costa described under genus. Eyes with greatest width of basal outline equal to four-fifths of the greatest length of the same, latter dimen-

[70] From the Pichis Trail and the Pichis Valley of the Ucayali drainage of Peru.

[71] The Pichis Trail leads from near La Merced in the Perené Valley, above the entrance of the Rio Paucartambo, northward across a range of mountains dividing the Rio Perené from the upper Rio Pichis, which latter flows into the Rio Pachitea. The Trail terminates on the north at or near Puerto Yessup on the Rio Pichis. Apparently the locality from which the type of *Paracrites pichis* came is on the dividing ridge between these two subsidiary systems of the Rio Ucayali.

sion slightly greater (as 29 to 26) than the least infra-ocular depth of the genae. Antennae described under genus.

Pronotum with its sculptural features given in the generic description, the sublongitudinal impression or "squeezing" of the surface of the lateral lobes immediately ventrad of the accessory shoulders of the disk quite marked and appreciably concave, but failing to reach the caudal margin of the lobes, the accessory (or lateral) shoulders of the disk while clear in emphasis cephalad are there broken into bead-like or nodulose sections, and become progressively less definite caudad. Mesosternal, metasternal and general abdominal features given under the genus.

Supra-anal plate with median exposed length one and one-half times its greatest width submesad, the distal margin of the penultimate tergite, in which the base of the supra-anal plate is inset, deeply brace-shaped emarginate to receive the plate, transverse median division of the supra-anal plate subarcuate, surface of the proximal half deeply and rather broadly sulcate medio-longitudinally, lateral bounding carinae of sulcus subnodiferous, the more lateral portions of the plate appreciably excavate, distal section of plate elongate acute trigonal, its median length equivalent to one and one-sixth times its proximal width at the transverse division of the plate, surface of distal section with one major proximal and a few minor nodules, the surface of the same section decurving as seen in profile. Cerci not surpassing the apex of the supra-anal plate. Subgenital plate as seen in dorsal aspect with its caudal outline broadly rounded, slightly flattened mesad, as seen in caudal aspect its dorsal compression is marked, so that the dorso-lateral margins are closely placed and subparallel as seen from dorsum, with their distal juncture very narrowly rounded.

Prosternal production definitely transverse lamellate, vertical as seen in profile, definitely broad trigonal-linguiform as seen in cephalic aspect, the distal margin rounded. Interspace between mesosternal lobes in width equal to one and one-half times the breadth of a single lobe.

Features of limbs presented in the generic description.

Coloration.—General tone russet, tending toward mars brown on immediate dorsum, becoming as pale and as live rufous as sanford's brown (Ridgway) on the caudal femora, while the venter is solidly polished deep fuscous except for a medio-longitudinal orange rufous bar of uniform width, which extends from the metasternal foveolae to the base of the antepenultimate abdominal sternite. Antennae between russet and tawny, eyes pale liver brown, inconspicuously mottled with fuscous. Shining areas proximo-laterad on the abdomen blackish fuscous; penultimate abdominal sternite with a subcircular fuscous maculation. Ventral and internal surfaces of the caudal femora largely fuscous; caudal tibiae dull brazil red, the spines black tipped; all tarsi washed with brazil red, the distal portion of the third and all of the second articles washed with fuscous.

Measurements: length of body, 15.9 mm.; length of pronotum, 2.77; greatest width of pronotum across lateral lobes, 3.5; length of caudal femur, 8.1.

Remarks.—The type of this striking species is unique. In distribution it may be limited to the Subtropical Life Zone of the Pichis and Perené areas of Ucayalian Peru. The elevations given as those between which the type was taken (4000–6000 feet) would indicate Subtropical conditions.

ELYSIACRIS[72] new genus

1851. *Tropinotus* Blanchard, in Gay, Hist. Fis. y Polit. de Chile, Zool., VI, p. 63. [In part only.[73]] (Not *Tropinotus* Serville, 1831.)

This genus and *Tropidostethus* Philippi, standing at the opposite end of the Tristirae series from *Bufonacris* and its near relatives, show collectively certain differential features which under other conditions would cause their prompt segregation as representatives of another group. However, the possession of other characters in common with those genera which here immediately precede this one indicate the first mentioned differential features are of less fundamental worth than might otherwise be supposed.

The genera *Elysiacris* and *Tropidostethus* agree in having strikingly compressed forms, definitely rostrate fastigia, in section markedly acute tectate pronota, the very narrow dorsal disks of which are clearly delimited from the lateral lobes, tuberculate or spinose prosterna and a definitely apical spine present distad on the external margin of the caudal tibiae. I am unacquainted with the male sex of either genus, so it is impossible to compare male genital features, but both genera agree in having the ovipositor valves of the female elongate and narrow, appreciably compressed and with the dorso-lateral margins serrulate. The two genera are not only unusual in their general facies, but verge so much on the bizarre that one is tempted at first glance to consider some of their features teratogenic.

From *Tropidostethus* the present genus can at once be distinguished by the depressed and subensiform antennae, by the presence of a delicate but distinct medio-longitudinal carinula on the fas-

[72] From *'ηλύσιον, Elysian fields, said by Homer to be at the western border of the earth,* and *ακρις, a locust,* in allusion to the western bordering position of Chile.

[73] Blanchard divided *Tropinotus,* as used by him, into two sections, of which the first included only his *angusticollis,* thus being completely equivalent to *Elysiacris* here proposed, while the other section contained two more of his species, i.e. *T. sulcaticollis* and *ornaticollis,* both of which, we now know, belong to the genus *Catrcolus* Uvarov (*Catreus* Stål, not of Cabanis).

tigium, occiput and pronotum, the less strongly rostrate character of the fastigium, the non-carinate lateral shoulders of the pronotal disk, the non-excavate pronotal disk, the transversely bituberculate prosternal protuberance and the lack of definite serrato-dentations on the median carina of the caudal femora. While as a whole *Elysiacris* has a number of feature combinations of unusual type, perhaps the most unusual single characteristic is the transverse disposition of the pair of acute tuberculate protuberances on the prosternum. These are, as far as I can recall, unique among the locusts.

GENOTYPE: *Tropinotus angusticollis* Blanchard.

Generic features.—Female only. Form strongly compressed, acutely tectate dorsad. Apterous. Surface shagreenous, also with numerous tubercles which on the cephalic and caudal margins of the lateral lobes of the pronotum become short marginal rugulae. Head short rostrate, fastigium when seen from dorsum subequal in length to the exposed occiput, its shape in this view elongate semi-elliptical, with the proximal width and median length subequal, least interspace between eyes somewhat less than proximal width of fastigium, surface of fastigium and occiput with a delicate mediolongitudinal carinula extending to the fastigial apex, postocularly the sides of the occiput bear short carinulae; in profile the rostration of the fastigium is moderately and nearly straight ascending dorso-cephalad, the immediate fastigio-facial angle acute, the ventral outline of the rostrum subangularly convex to the median ocellus, where the profile is moderately indented, thence the facial line is more strongly and subvertically convex to the clypeal suture; lateral foveolae of vertex not delimited, these areas appreciably excavate and passing broadly into those of the antennal fossae, lateral ocelli placed close to eyes; frontal costa strongly compressed, undivided and sublamellate except for ventral third, the lateral carinate margins briefly opening for a short foveolate section immediately ventrad of the fastigio-facial angle, and about median ocellus and for a short distance dorsad of the same the margins are narrowly separated, and finally in the usual triangle dorsad of the clypeal suture the margins concavely diverge ventro-laterad, leaving the intervening triangle subexcavate, both the single lamellate and the paired margins with scattered nodose tubercles, costal surface where margins diverge distinctly sulcate or sulcate-excavate; clearly indicated lateral (accessory) facial carinae present. Eyes little prominent from dorsum, seen in profile the base outline of the eye is ovate trigonal, its greatest width subequal to two-thirds its greatest depth, the latter equalling the least infra-ocular depth of the genae. Antennae subequal in length to the pronotal dorsum, depressed, appreciably ensiform, bluntly acute at apex, composed of 8 articles.

Pronotum strongly compressed, in profile moderately ascending caudad, median carinula undivided longitudinally near the cephalic margin, then nar-

rowly splitting into two contiguous carinulae continued over the thoracic nota and with this double character maintained caudad over most of the abdominal tergites, in the adult the pronotal carinular group is transversely severed three times, i.e. at caudal fourth, slightly caudad of middle and briefly cephalad of same; lateral shoulders of subobsolete pronotal disk indicated as continuations of the cephalic postocular carinae, separated at cephalic margin by a narrow discal section subequal in width to that between eyes, then sharply converging, continuing and narrowly flanking the paired median carinulae, becoming progressively obsolete; narrow cephalic margin of discal section arcuate, caudal margin of same narrowly V-emarginate mesad: lateral lobes subrectangulate, appreciably deeper than long; cephalic margin shallowly bisinuate, ventro-cephalic angle sharply rectangulate, ventral margin oblique subsinuate, ventro-caudal angle narrowly rounded subacute, caudal margin weakly obtuse-angulate, slightly sinuate in part, relatively regularly spaced short longitudinal rugulae adjacent to both cephalic and caudal margins marked in emphasis, subtuberculate at the marginal ends, principal transverse sulcus indicated only weakly dorsad on lobes, median one evident only ventrad on lobes, surface as a whole with numerous scattered rasp-like points. Mesonotum, metanotum and abdominal tergites similar in development and pronounced tectation, in profile the dorsal outline of each abdominal tergite is individually low arcuate, its texture subnodulose.

Supra-anal plate of female proximad deeply seated into the emargination of the preceding tergites, its free margin trigonal, the plate transversely divided in two, both sections continuously sulcate medio-longitudinally. Cerci of female very short, stout proximad, apex submammiform attenuate. Ovipositor valves as seen from dorsum slender and compressed, in profile the dorsal ones are moderately deep, bluntly and briefly recurved at apices, dorso-lateral margins serrulate, ventral valves shallow and attenuate, apices briefly decurved, lateral plates acute lanceolate. Subgenital plate of female with distal margin having on each side an infra-valvar obtuse angulation and mesad an acute inter-valvar production which is carried dorsad between the ventral ovipositor valves as a vertical lamellation. Prosternum with a transversely disposed process which bears a transversely placed pair of trigonal protuberances. Interspace between mesosternal lobes strongly transverse, internal margins of lobes subparallel, caudal margins of same oblique truncate. Metasternal foveolae separated by an interspace not more than half that between mesosternal lobes.

Cephalic and median limbs very short, femora subcompressed, widening distad, surface rugulosely carinate, tibiae subcompressed. Caudal femora subcompressed, moderately slender, medio-dorsal carina weakly lamellato-arcuate proximad,[74] sparsely serrulate mesad and distad, paginal pattern definite but not regular, dorsal paginal carina sparsely serrulate, ventral one entire, ventro-external face somewhat expanded, subdeplanate, genicular lobes with ventral margin arcuate and apex rounded rectangulate: caudal tibiae with nine external and nine internal spines, including one definitely apical on

[74] See specific comments for special condition of material examined.

each margin, internal spines subequal in length, each well arcuate distad: tarsal claws equal in length, arolium well developed.

Male sex unknown to me.

While in some ways *Elysiacris* is even more divergent than is *Tropidostethus* from what may be called the "mean" condition of the Tristirae, in other respects, such as the pronotal structure with its retention of a medio-longitudinal carina, and the absence of a single marked median prosternal spine, it is more in accord with the genera already treated than is *Tropidostethus*. It seems most logical to consider *Elysiacris* and *Tropidostethus* as divergent lines springing from a not too remote common ancestry, but *Tropidostethus* seems to have carried the evolution of certain features to a more marked stage of differentiation than has *Elysiacris*. In consequence it seems best to give the former the most extreme, and hence terminal, position.

I know but the genotypic species of *Elysiacris*. It occurs in south central Chile, but our information on the distribution of the genus is very limited.

Elysiacris angusticollis (Blanchard)

(Text-figs. 15, 16, 29 & 30; pl. IV, fig. 11, pl. IX, fig. 32.)

1851. *Tropinotus angusticollis* Blanchard, in Gay, Hist. Fis. y Polit. de Chile, Zool., VI, p. 65.[75] [Sex ?; Chile.]

CHILE: Cerros de Nahuelbuta,[76] Angol. Malleco Province; 1938; (P. Torres); 1 ♀; [A.N.S.P.]. Mulchén, Bio Bio Province; March 4, 1921; (Hector Pinochet); 1 juv. ♀; [A.N.S.P.].

Blanchard concluded from the apterous condition of the material before him that it represented a larval stage. He emphasized the species showed features distinct from those of true *Tropinotus,* which is, as we know, a very distinct romaleid genus, but in the absence of alate individuals he felt unable to erect a new genus.

[75] Blanchard refers in his text to "Atlas Zoológica.-Entomológia, Ortópteros, lám. 3, fig. 5," for an illustration of this species, but I have never found more than a single plate of Orthoptera in this work. Kirby (Synon. Catal. Orth., III, p. 361, (1910)) gives "ined." after his quoted reference to the figure, and Scudder (Proc. Amer. Acad. Arts and Sci., XXXIV, no. 17, p. 473, (1899)) states that four copies of Gay's work were examined by him but all had no more than a single plate of Orthoptera. I fully agree with Scudder's conclusion that, "I cannot discover that more than one plate of Orthoptera was ever published." The copy of the Atlas in the library of the Academy of Natural Sciences of Philadelphia, which was not examined by Scudder, is now before me, and it also possesses but one Orthoptera plate.

[76] This range lies approximately twenty kilometers due west of the town of Angol.

It is now evident that this genus is, like all of its closer relatives, always apterous.

Of the two female specimens before me that from the Cerros de Nahuelbuta is apparently adult, that from Mulchén is in the instar preceding maturity. The generic description given above and the accompanying figures supply virtually all the important features of this most distinctive genus and species. Certain ones, however, will be more readily understood if the following more critical comments, drawn, unless otherwise stated, from the Cerros de Nahuelbuta adult, are considered.

Fastigium as seen from dorsum with lateral margins proximad low nodose, then gently near straight convergent to the rounded apex, dorsal surface of fastigium shallow subexcavate, its sculpture rasp-like shagreenous; interocular region and occiput with a pair of irregular carinae paralleling the median carinula and extending from the fastigial base caudad over the occiput (little evident in immature female), these carinae bearing scattered low tuberculoid points; postocular carinae fairly well marked, moderately converging caudad as seen from dorsum. Antennae with each article well defined except for the less definite distinction between the two distal ones, the others marginally well delimited as seen from dorsum. Pronotum with the disk represented only by a narrow transversely rounded area, sharply narrowing caudad, marked off from the subvertical lateral lobes by the noncarinate but strongly shagreenous lateral shoulders, which are more pronounced and rasp-like in the adult than in the immature female. Caudal femora reaching caudad to the sixth or seventh abdominal tergite, depth mesad contained four times in the greatest femoral length, dorso-external face of femora with scattered shining shagreenoid points, these subobsolete in the immature individual, median carinal area proximad in the single adult seen abruptly compressed and lamellately elevated, the compression even involving most of the dorsal half of the external pagina,[77] in the immature

[77] It is hard to believe the condition seen in this adult is normal, or that it is not due to an injury. It suggests very greatly the type of injury which could have been made on an immature insect by the pinch of a bird's beak, yet against this is the fact that it is exactly and symmetrically the same on both caudal femora of the adult, the body itself showing no trace of any injury, and in the immature specimen the dorsal expansion of this area is indicated very clearly and a mild degree of compression is also shown, although not cut off sharply from the more normal cross-section of the remainder of the femur. The symmetry of this pronounced pinching speaks strongly against an accidental and adventitious origin, yet considering the great strength and unusual character of the compression one finds it hard to conclude it is a normal condition. Additional material is needed to determine this point. In the meantime I have refrained from utilizing or stressing this remarkable structural appearance in the key to the genera or in the generic diagnosis. If, however, this compression is found to be normal in adults, it should be considered a generic feature.

individual the arcuate elevation of the median carina is less abrupt but still decided, while the compression and sharp delimitation of this area, as seen in the adult, is much less marked and the surface less shagreenous; caudal tarsi relatively short, the whole slightly less than a fourth as long as the caudal tibia.

Coloration.—Pale base color cinnamon-buff to cinnamon, in the immature specimen of the latter shade virtually unsuffused, in the adult very heavily and completely washed with bister, the base color showing through only in points, on some ridges and as scattered clouds or obscure streaks. Internal face of caudal femora in adult only blackish fuscous, tibial spines blackish fuscous tipped.

Measurements (in millimeters)

	Length of body	Length of pronotum	Greatest caudal width of pronotum	Length of caudal femur
♀, Cerros de Nahuelbuta, Chile	25.3	3.74	5.	10.4
Juv. ♀, Mulchén, Chile	25.4	3.42	5.21	10.7
Sex ? *Ex Blanchard*	23.1–31.5	—	—	—

Distribution.—I am able to cite only the two localities represented by the material before me, i.e. Mulchén and Cerros de Nahuelbuta, these in south-central Chile in or adjacent to the great central valley. How much more widely the genus extends is not known, and with no available information on its habits or actions, further speculation is unwarranted. Whether *Elysiacris* and *Tropidostethus* occur in the same territory is equally unknown, although the information now available would lead to the conclusion they do not, and that *Elysiacris* is found to the north of the territory in which *Tropidostethus* is known to be present.

TROPIDOSTETHUS Philippi

1863. *Tropidostethus* Philippi, Zeitschr. für Gesammt. Naturwiss., XXI, p. 245.

1878. *Tropidostethus* Stål, Bihang K. Svenska Vet.-Akad. Handl., v, no. 4, p. 13.

1887. *Tropidostethus* Pictet and Sassure, Bull. Soc. Entom. Suisse, VII, p. 334.

As has already been shown under the preceding genus *Elysiacris* these two are very distinctive types, agreeing in certain important features when contrasted with the genera preceding them in the present arrangement of the Tristirae, yet differing from one another in almost equally important respects.

The generic name *Tropidostethus* was applied by Philippi after having described the genotypic species as an aberrant member of the genus *Batrachopus,* and no summary of generic characters was given by him. The first summary of differential features was that given by Stål, which is cited above, while the sole analysis of the generic characteristics was given by Pictet and Saussure. The latter, however, is far better than most of those of similar scope given by contemporary authors, and it summarizes very well the more important features of the genus. In consequence it is not necessary to give here a new character summary for *Tropidostethus.* Their notes, and the illustrations here given—the first ever published of the genus—will permit the ready recognition of the insect. I am unacquainted with the features of the male sex, other than what may be known from the comments of previous authors.

GENOTYPE (by original designation).—*Batrachopus? bicarinatus* Philippi.

But a single species has been referred to the genus. Apparently *Tropidostethus* is of circumscribed distribution, as far as known occurring only in Valdivia and Llanquihue Provinces of southern Chile.

Tropidostethus bicarinatus (Philippi)

(Text-figs. 17, 18 & 31; pl. IX, figs. 33 & 34.)

1863. *B[atrachopus]? bicarinatus* Philippi, Zeitschr. für Gesammt. Naturwiss., XXI, p. 244. [♂, ♀; Valdivia Province, Chile.]

1887. *Tropidostethus bicarinatus* Pictet and Saussure, Bull. Soc. Entom. Suisse, VII, p. 334.

CHILE: Rio de Valdivia, Valdivia Province; (A. Montealegre); 1 ♀; [A.N.S.P.]. Puerto Varas, Llanquihue Province;[78] April 8–9, 1920; (Cornell Univ. Exped.); 1 juv. ♀; [Cornell Univ.].

The specific description of this insect given by Pictet and Saussure (vide supra), when taken with their generic diagnosis, presents the major features of this most distinctive type. Philippi's original description gives a few points not covered by Pictet and Saussure, but the two combined remove the necessity for a redescription. The very distinctive pronotal structure of the genus and species alone should permit its prompt recognition.

[78] Puerto Varas is on the south shore of Lago de Llanquihue, about twenty kilometers north of Puerto Montt. Its approximate position is 41° 20′ S., 72° 55′ W.

The adult before me has been dried from alcohol, and in consequence is completely decolored, except for the blackish fuscous elevated shagreenous points scattered over the body and on the serrations of the caudal femoral carinae. The spines of the internal margin of the caudal tibiae, rather curiously, are blackish fuscous distad and proximad as well on the internal face; the spines of the external margin are fuscous only distad. The immature female has preserved its natural coloration of nearly uniform dull mahogany red, the tubercles less conspicuously fuscous than in the adult.

Philippi gave the number of antennal articles as 8, Stål said 9, Pictet and Saussure gave "8–9," and the single remaining antenna of the adult female before me shows 9. The immature female lacks both antennae. Stål speaks of the antennae as "subensiform," which is hardly correct. It is true the fourth and fifth articles are very faintly broader than the third and sixth, but there is nothing approaching a truly ensiform condition, and no approximation of that seen in *Elysiacris*. Philippi was more correct in calling the antennae "fadenförmig," and Pictet and Saussure's "déprimées, subfiliformes" truthfully presents their general characteristics.

The last mentioned authors give the number of caudal tibial spines as 8 on each side. Both the adult and the immature specimen now before me show 8 on the external margin and 9 on the internal. It is possible the smaller proximal spine seen in my material may occasionally be absent.

Measurements (in millimeters)

	Length of body	Length of pronotum	Greatest width of pronotum	Length of caudal femur
♂, Valdivia Prov., *ex Philippi*	22 [79]	—	—	—
♂, "Chile," *ex Pictet and Saussure*	19	3.8	—	— [80]
♀, Valdivia Prov., *ex Philippi*	33.6	—	—	—
♀, "Chile," *ex Pictet and Saussure*	28	5.8 [81]	—	14 [80]
♀, Rio de Valdivia	33.2	4.7	6.5	14

[79] Given originally in lines, and here converted into millimeters.

[80] Pictet and Saussure have given the length of the caudal femora as "♀ 14, ♂ 20.7 mm." It is evident from my material that the figure given for the female is correct, but what 20.7 for the male really means it is impossible to say.

[81] I feel certain that in this measurement the length of the mesonotum has been included.

The two localities represented by material now studied constitute the only exact records we have for the species, and with the addition of Philippi's original citation of Valdivia Province they comprise our entire geographic knowledge of the genus. It is quite probably localized in southern Chile, but until more information is available nothing further can be added on its range or occurrence.

Explanation of Figures

Plate III

Fig. 1.—*Bufonacris terrestris* Walker. Male. Gregory Bay, Straits of Magellan. Dorsal view. (× 1⅓.)

Fig. 2.—*Bufonacris terrestris* Walker. Female. Gregory Bay, Straits of Magellan. Dorsal view. (× 1⅓.)

Fig. 3.—*Incacris phaenogaster* new genus and species. Female (*type*). Conchamarca, Peru. Dorsal view. (× 4.)

Fig. 4.—*Crites prestoni* new genus and species. Female (*type*). Leonpampa, Peru. Lateral view. (× 2¾.)

Fig. 5.—*Crites prestoni* new genus and species. Female (*type*). Leonpampa, Peru. Dorsal view. (× 2¾.)

Fig. 6.—*Crites prestoni* new genus and species. Male (*allotype*). Leonpampa, Peru. Dorsal view. (× 4.)

Plate IV

Fig. 7.—*Bufonacris terrestris* Walker. Male. Gregory Bay, Straits of Magellan. Lateral view. (× 1⅓.)

Fig. 8.—*Bufonacris terrestris* Walker. Female. Gregory Bay, Straits of Magellan. Lateral view. (× 1⅓.)

Fig. 9.—*Crites prestoni* new genus and species. Male (*allotype*). Leonpampa, Peru. Lateral view. (× 4.)

Fig. 10.—*Paracrites pichis* new genus and species. Male (*type*). Pichis Trail, Peru. Dorsal view. (× 4.)

Fig. 11.—*Elysiacris angusticollis* (Blanchard). Female. Cerros de Nahuelbuta, Chile. Lateral view. (× 2⅔.)

Plate V

Fig. 12.—*Papipappus clarazianus* Saussure. Male. Tucura Catanlil, Nequen, Argentina. Dorsal view of head, thorax and proximal abdominal segments. (× 2.)

Fig. 13.—*Papipappus clarazianus* Saussure. Male. Tucura Catanlil, Nequen, Argentina. Lateral view of head, thorax and proximal abdominal segments. (× 2.)

Fig. 14.—*Peplacris recutita* new genus and species. Female (*type*). Province of Valparaiso, Chile. Lateral view. (× 4.)

Fig. 15.—*Peplacris recutita* new genus and species. Female (*type*). Province of Valparaiso, Chile. Dorsal view. (× 4.)
Fig. 16.—*Punacris peruviana* (Saussure). Male. Oroya, Peru. Dorsal view. (× 4.)

Plate VI

Fig. 17.—*Moluchacris bufo* new genus and species. Female (*type*). Talcahuano, Chile. Dorsal view. (× 4.)
Fig. 18.—*Moluchacris bufo* new genus and species. Male (*allotype*). Talcahuano, Chile. Lateral view. (× 4.)
Fig. 19.—*Moluchacris cinerascens* (Philippi). Female. Angol, Chile. Dorsal view. (× 4.)
Fig. 20.—*Moluchacris cinerascens* (Philippi). Female. Angol, Chile. Lateral view. (× 4.)

Plate VII

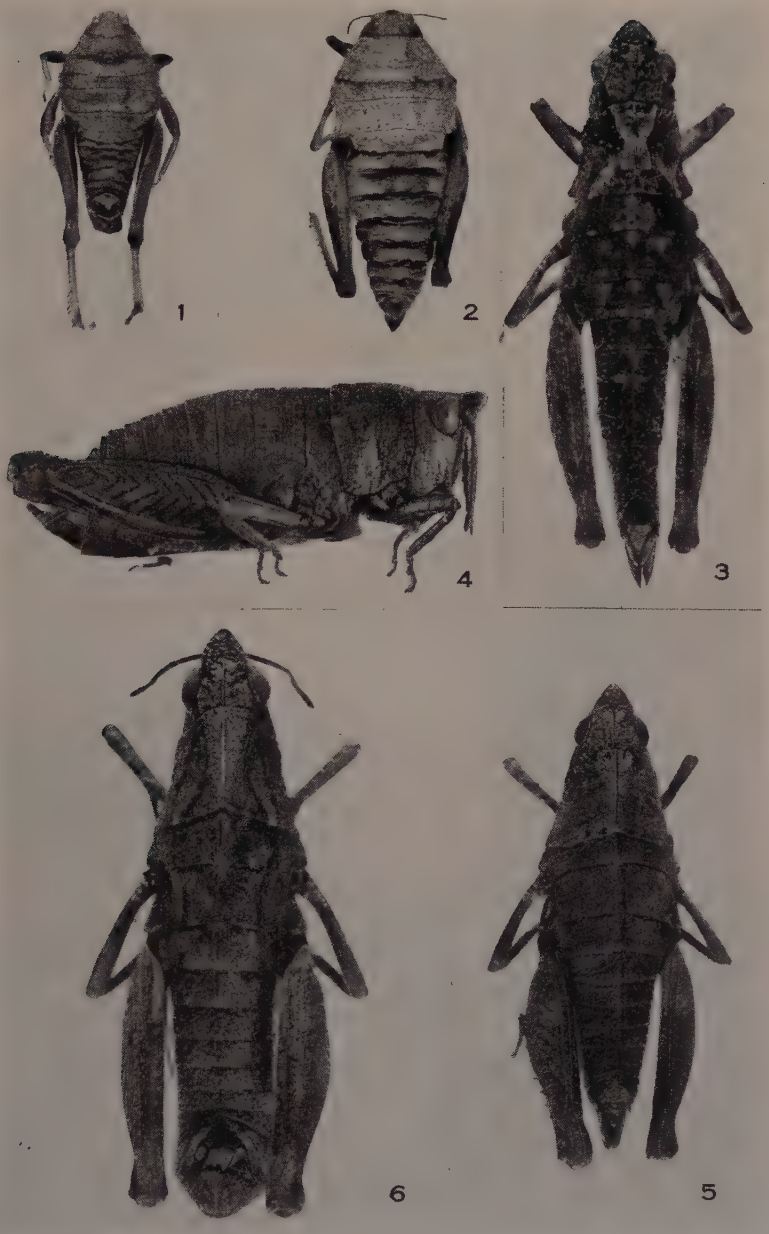
Fig. 21.—*Moluchacris bufo* new genus and species. Female (*type*). Talcahuano, Chile. Lateral view. (× 4.)
Fig. 22.—*Moluchacris bufo* new genus and species. Male (*allotype*). Talcahuano, Chile. Dorsal view. (× 4.)
Fig. 23.—*Moluchacris cinerascens* (Philippi). Male. Angol, Chile. Dorsal view. (× 4.)
Fig. 24.—*Moluchacris cinerascens* (Philippi). Male. Angol, Chile. Lateral view. (× 4.)

Plate VIII

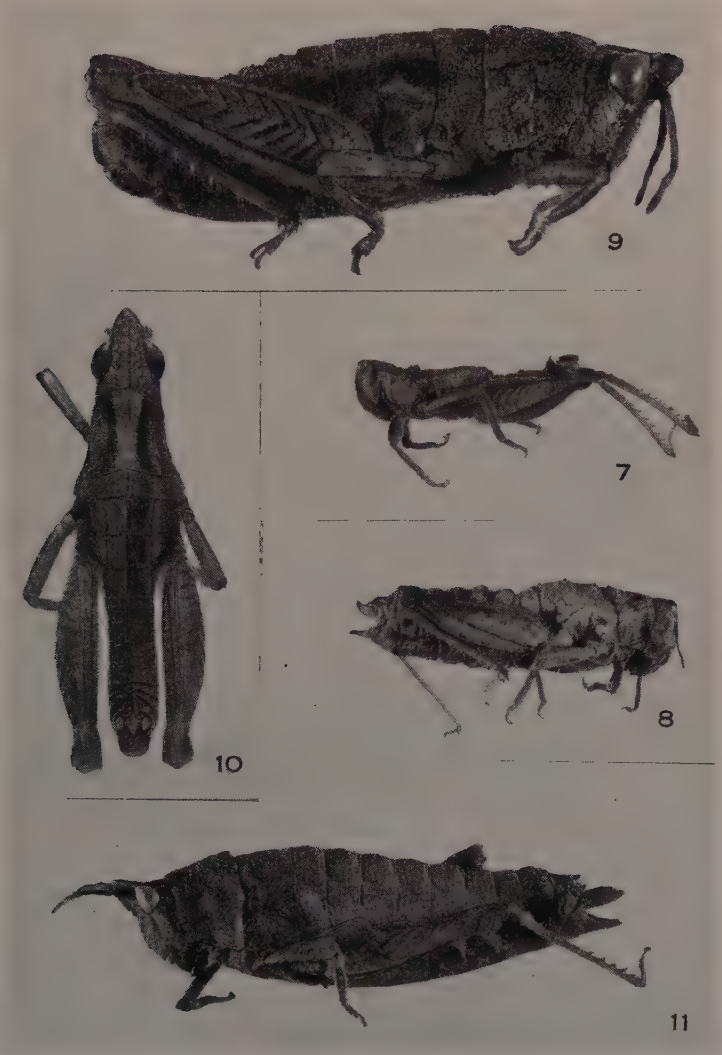
Fig. 25.—*Punacris peruviana* (Saussure). Male. Oroya, Peru. Lateral view. (× 4.)
Fig. 26.—*Punacris peruviana* (Saussure). Female. Oroya, Peru. Dorsal view. (× 4.)
Fig. 27.—*Punacris peruviana* (Saussure). Female. Oroya, Peru. Lateral view. (× 4.)
Fig. 28.—*Incacris phaenogaster* new genus and species. Male (*allotype*). Conchamarca, Peru. Dorsal view. (× 4.)
Fig. 29.—*Incacris phaenogaster* new genus and species. Male (*allotype*). Conchamarca, Peru. Lateral view. (× 4.)
Fig. 30.—*Incacris phaenogaster* new genus and species. Female (*type*). Conchamarca, Peru. Lateral view. (× 4.)
Fig. 31.—*Paracrites pichis* new genus and species. Male (*type*). Pichis Trail, Peru. Lateral view. (× 4.)

Plate IX

Fig. 32.—*Elysiacris angusticollis* (Blanchard). Female. Cerros de Nahuelbuta, Chile. Dorsal view. (× 2⅔.)
Fig. 33.—*Tropidostethus bicarinatus* (Philippi). Female. Rio Valdivia, Chile. Lateral view. (× 2.)
Fig. 34.—*Tropidostethus bicarinatus* (Philippi). Female. Rio Valdivia, Chile. Dorsal view. (× 2.)



REHN—SOUTH AMERICAN TRISTIRAE



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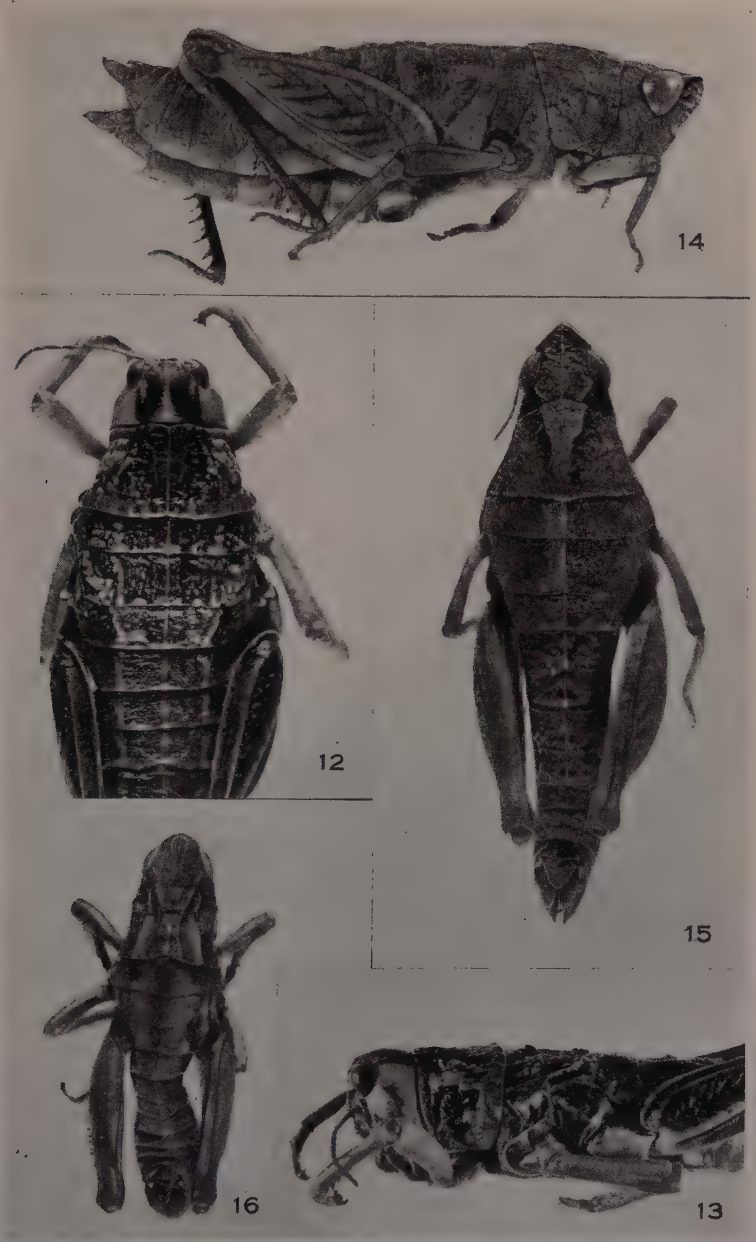

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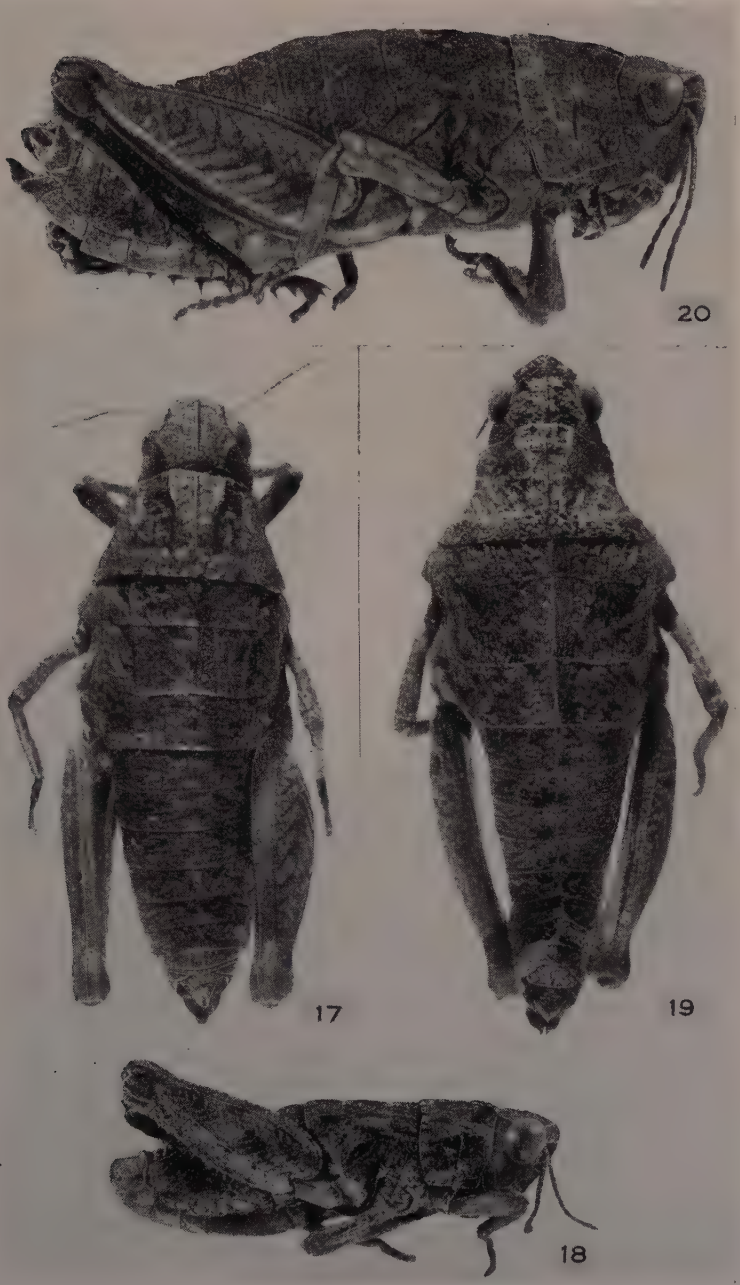

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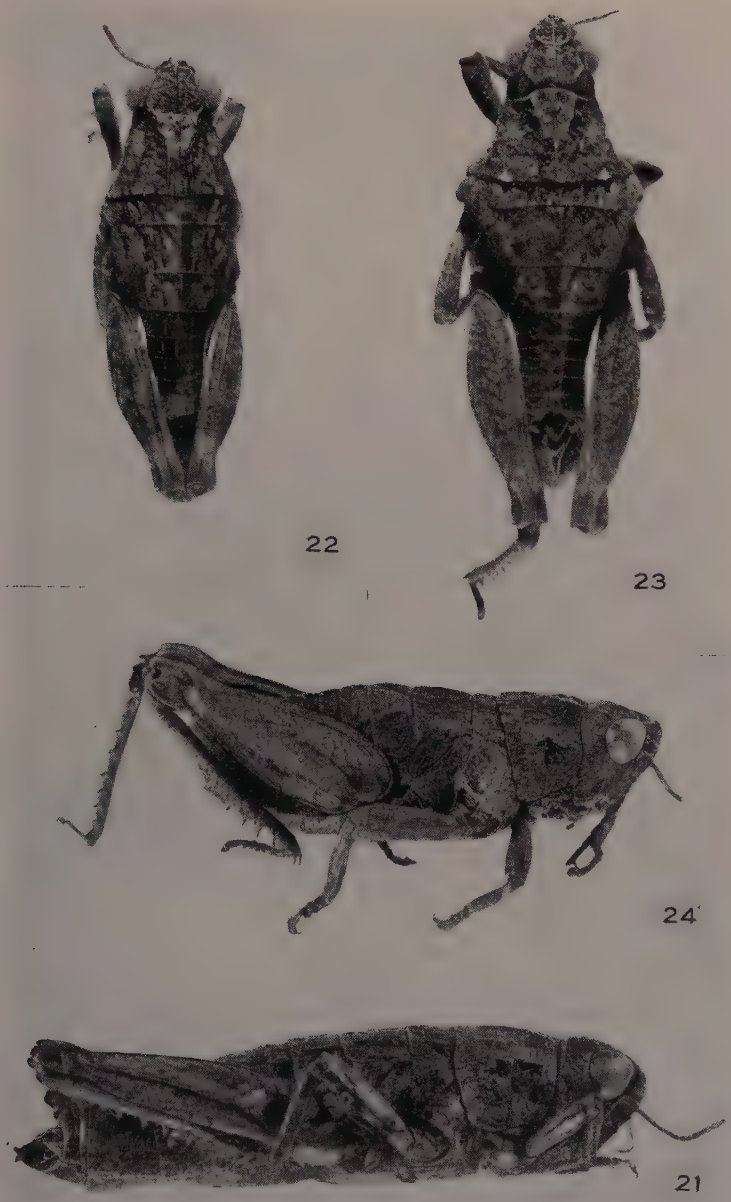

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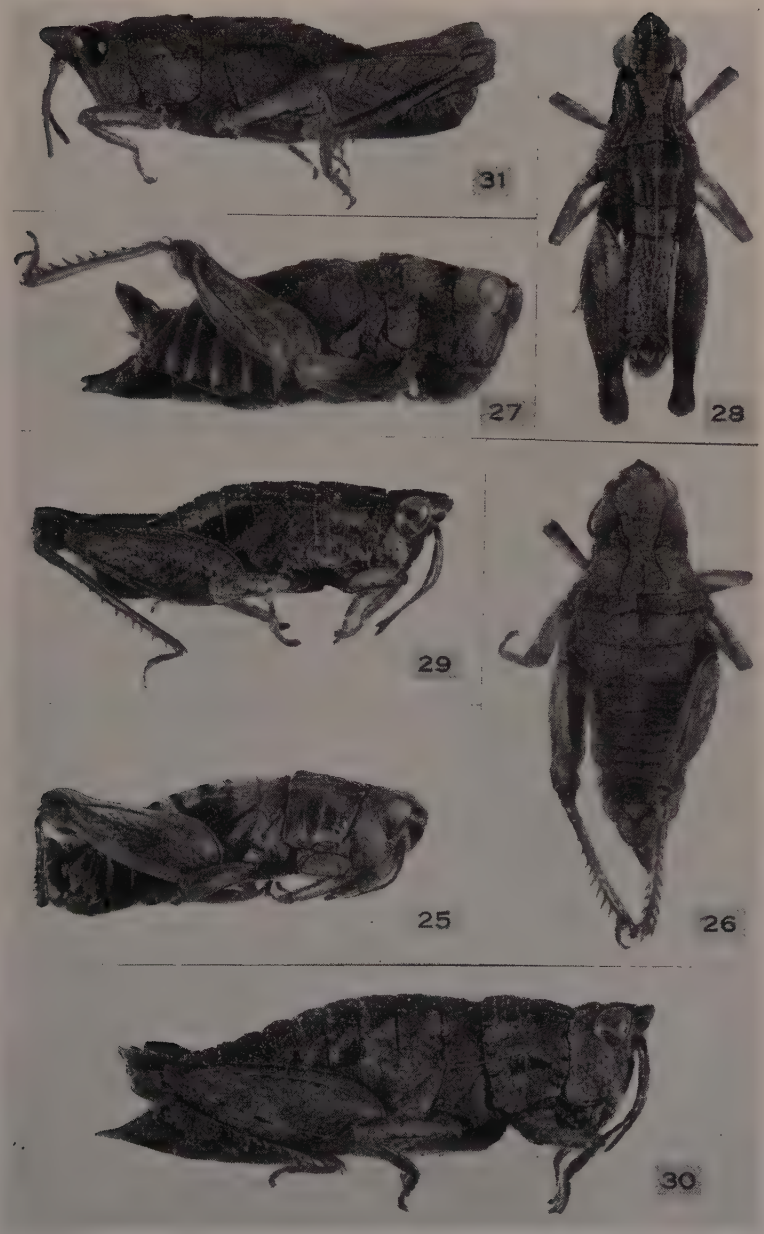

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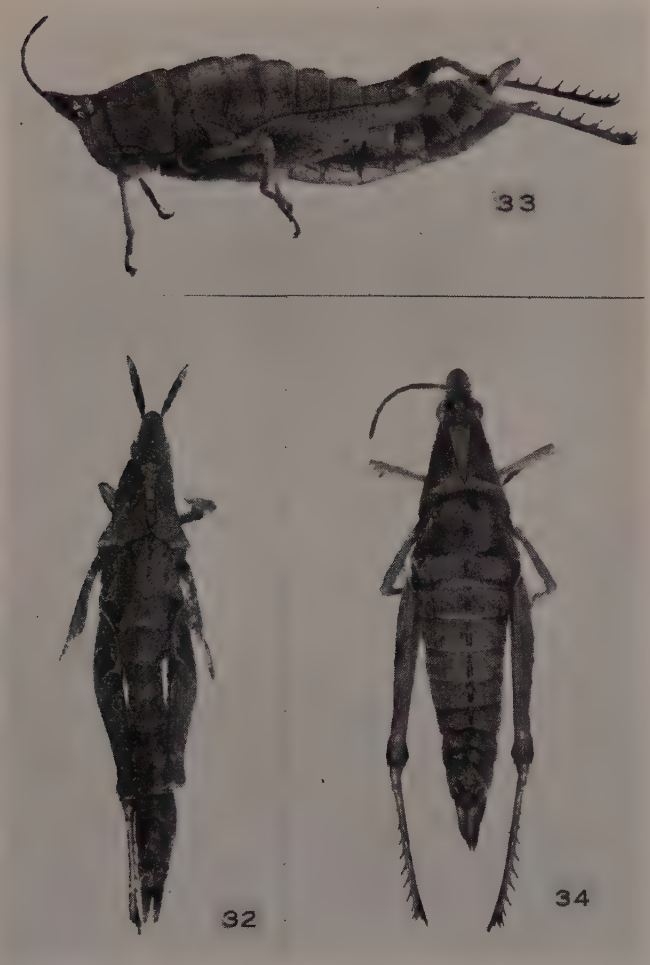

REHN—SOUTH AMERICAN TRISTIRAE

SYNOPSES OF NORTH AMERICAN EPHYDRIDAE
(DIPTERA)

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This series of papers is intended to present a systematic arrangement of the species of the Ephydridae as I have placed them in my contemplated monograph of the Ephydridae of North America. It will also contain descriptions of new genera and species as may be found in the course of my work on that treatise. In the past many of the new genera and species thus encountered have been published in a series of papers under the title "Descriptions of New Genera and Species of the Dipterous Family Ephydridae." [1] The present series will continue to serve in that field but will be augmented by keys to the genera and species of the groups specified. It is the hope of the writer that these keys will be thoroughly tested by other students as far as their material will allow.[2]

It may be, that long before my monograph is published, keys to most if not all of the species will have been treated in the present series. The original bibliographical reference is given for each genus and species but none referring to generic changes, so no new combination is intended to be considered except where mentioned.

In order to give some idea of the distribution and abundance of the species, some remarks are given along these lines. As regards distribution, I use the general terms: North, for those occurring

[1] I. Entom. News, XXV, pp. 241–250, pl. 10, 1914. II. Entom. News, XXVI, pp. 68–72, 1915. III. Entom. News, XXVII, pp. 147–152, 1916. IV. Entom. News, XXVIII, pp. 340–341, 1917. V. Entom. News, XXXIII, pp. 135–137, 1922. VI. Entom. News, XXXV, pp. 159–164, 1924. VII. Entom. News, XXXVI, pp. 165–167, 1925. VIII. Entom. News, XLI, pp. 67–81, 1930. IX. Entom. News, XLII, pp. 104–108, 1931. X. Entom. News, XLII, pp. 168–170, 1931. Xa. Entom. News, XLIV, pp. 65–70, 1933. XI. Trans. Amer. Ent. Soc., LX, pp. 199–222, pl., 1934. XII. Notulae Nat., no. 38, 1940.

[2] In this the writer would be pleased to have any criticisms, and also requests the privilege of examining any specimens that do not appear to run out satisfactorily.

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north of the fortieth degree parallel and which practically includes the Boreal and Transition Life Zones of Merriam;[3] northeast refers to the eastern portion of that area and northwest to the western portion. East refers to the area east of the Rocky Mountains and south of the north area, practically the Austral Zone. Southeast and southwest are self evident. Occasionally more definite terms are used which do not need explanations; also Boreal, Transition and Austral may be used instead of the cardinal points. In some cases the species may be known from a few additional localities beyond the limits given.

The scarcity or abundance of a species as given is based on the number of specimens I have examined, and for convenience the following terms are used: Rare when not more than twenty-five specimens have been seen; scarce when not more than 100 and common when more than that number; abundant is used when the species is common and of general distribution.

I. The Subfamily Psilopinae, with Descriptions of New Species

Subfamily PSILOPINAE Cresson

1925. Trans. Amer. Ent. Soc., LI, p. 241.

A group of very small to medium size species, rarely exceeding three millimeters in length; without any discal macrochaetae on the mesonotum, excepting the prescutellars and posterior intra-alar which may be removed cephalad, and appear as such (i.e. true dorsocentrals absent). The lateral bristles of the frons are reclinate and/or proclinate, rarely the former may be somewhat latero-clinate; medifacies bare (never setulose) the series of facial bristles almost vertically parallel, or if the face is very short, the series may appear to converge dorsad, or to parallel the oral margin.

In this subfamily twenty-five genera and eighty-two species are recognized as occurring in North America as defined in the present paper. This is an increase of twenty-one genera and seventy species over that given by Aldrich in his catalogue, for the same region.

[3] Life Zones and Crop Zones of the United States. By C. H. Merriam. *U. S. Dept. Agr., Bur. Biol. Survey*, Bull. no. 10, 1898.

Key to the Genera of the North American Psilopinae

1. Shining black species with postbucca bare and its posterior margin sharp and reflexed (marginate) (Gymnopini, new tribe).....2
   Shining to opaque species with postbucca generally setulose and its posterior margin if sharp is not marginate.....4
2. Alula of wings broad, auriculate; frontals and occulars absent or very minute; antennae depressed into deep antennal cavity; arista bare; face tuberculose medianly; cheeks and postbucca extensive; but one notopleural present which is at extreme caudal angle.
   Gymnopa Fallen (p. 106)
   Alula of wings narrow; frontals and ocellars distinctly developed but may be somewhat appressed; antennae not particularly depressed; arista more or less distinctly pectinate; two notopleurals present, the posterior one slightly removed dorsad from ventral margin.....3
3. Face medianly tuberculose; mesonotal setulae in distinct, well separated series; polished black species without any trace of vestiture; fore femora without distinct flexor comb.
   Parathyroglossa ordinata (Becker) (p. 106)
   Face at most subgibbosely convex; mesonotal setulae irregular or indistinctly seriated medianly; shining surfaces more or less obscured by sculpturing or vestiture; fore femoral comb usually evident.
   Athyroglossa Loew (p. 106)
4. Posterior notopleural bristle distinctly removed dorsad from the notopleural sutural margin (less noticeable in *Pelignus*); aristal hairs curved (arista bare in *Glenanthe*); mostly densely pruinose species (Atissini, new tribe).....5
   Posterior notopleural bristle at or near sutural margin, at least not more removed than the anterior one; aristal hairs straight.....10
5. Eyes strongly constricted ventrad; arista bare.
   Glenanthe litorea Cresson (p. 107)
   Eyes normal; arista pectinate, but sometimes with hairs very short and the arista noticeably thickened on basal portion.....6
6. Face with prominent, bare shining, rounded, median tubercle; cheeks and postbucca very large and latter setulose and with sharp posterior margin.....*Hecamede albicans* (Meigen) (p. 107)
   Face without such tubercle.....7
7. Frontal bristles cephalad of line of ocellars, the latter caudad of line of anterior ocellus.....8
   Frontals about aligned with ocellars, the latter cephalad of line of anterior ocellus.....9
8. Face conically prominent above epistoma, with a median pair of up-curved setae.....*Atissiella* Cresson (p. 110)
   Face most prominent near epistoma, without such pair of up-curved setae.
   Atissa Haliday (p. 110)

9. Vein II long; costa II much longer than III; face most prominent well above epistoma.....*Allotrichoma* Becker (p. 108)
   Vein II short; costa II not much longer than III; face not noticeably prominent.....*Pelignus* Cresson (p. 109)
10. Ocellars situated caudad of line of anterior ocellus, sometimes between the posterior ocelli, far caudad of line of frontals and frontorbitals (the latter sometimes weak); antennae generally of the complex Notiphiline type; mostly shining to polished species.....16
    Ocellars situated cephalad of line of anterior ocellus and about aligned with frontals and anterior frontorbitals; antennae generally of the simple, Gymnopine type; mostly opaque pruinose species (Discocerinini new tribe).....11
11. Face with a secondary series of dorso-laterally inclined setae laterad of the primaries; eyes pilose; notopleura setulose.
    Polytrichophora Cresson (p. 114)
    Secondary series absent or may be suggested by mesally inclined setulae or (in *Diclasiopa* a dorso-laterally inclined setae at lower extremity of facialia).....12
12. Notopleura and parafacies bare; the anterior notopleural situated cephalad, well in anterior angle of notopleura, about equidistant between humeral and posterior notopleural.....14
    Notopleura setulose, and/or anterior notopleural removed caudad closer to posterior notopleural.....13
13. Densely cinereous, opaque species; parafacies and cheeks rather broadly developed.....*Hydrochasma* Hendel (p. 113)
    Shining to dark opaque species; parafacies and cheeks rather narrow.
    Discocerina Macquart (p. 114)
14. Facial series of at least three primaries; opaque, densely cinereous species with frons, mesonotum and abdomen darker; upper facial on distinct shining papilla...*Hecamedoides glaucella* (Stenhammar) (p. 117)
    Facial series of two primaries; parafacies bare.....15
15. Mostly opaque cinereous species; facialia with distinct up-curved seta at lower extremity.....*Diclasiopa lacteipennis* (Loew) (p. 117)
    Mostly shining species; facialia without any such up-curved seta.
    Ditrichophora Cresson (p. 117)
16. Setation weak and many characteristic setae absent; head much flattened in profile, with very sharp vertex; face generally definitely sculptured; facialia rather broad but not always easily defined, with three or more facials in series well removed from parafacies; mesonotal setulae not seriated; generally shining species.....(Discomyzini new tribe) 25
    Setation well developed; face at most microscopically sculptured; facialia not defined; one, rarely more than two facials well developed, near

parafacies; mesonotal setulae generally seriated; generally smooth shining species.....(Psilopini new tribe) 17

17. Scutellum enormously developed, semiglobose, almost concealing abdomen (A Cuban species which may ultimately be found in Florida).
Peltopsilopa schwarzi Cresson

Scutellum normal, small, trigonal, not concealing any part of abdomen..18

18. Antennae normal; segment I at most but slightly exerted, II rather trigonal with distinct lobe and spine.....20

Antennae elongate; segment I distinctly exerted, II inversely conical (broader apicad) without superior lobe or stout spine, III long to more or less cylindrically elongate; ocellars rather approximate and caudad, almost between posterior ocelli...*Ceropsilopa* Cresson (p. 127)

20. Prescutellars present.....22

Prescutellars absent; tergites III and IV large, subquadrate.....21

21. Abdomen rather ovate with lateral margins revolute; rather shining, weakly granulose species....*Trimerinoides adfinis* (Cresson) (p. 123)

Abdomen slender, parallel-sided, flat with sharp, slightly reflexed margins; subopaque, granulose species....*Trimerina madizans* (Fallen) (p. 124)

22. Halteres dark; wings yellowish with blackish base; frontals weak, hairlike.....*Plagiopsis* Cresson (p. 126)

Halteres white; frontals well developed.....23

23. Medifacies more or less carinate with transverse wrinkles; the facial bristle at or above midfacial profile; fore metatarsis black and somewhat thickened.....*Leptopsilopa* Cresson (p. 126)

Medifacies at most weakly carinate or subglobose, at most weakly wrinkled; two or more facials.....25

Medifacies at most weakly convex, generally smooth and polished, rarely niveous; antennal foveae as grooves; one facial below midfacial profile; fore tarsi slender.....*Psilopa* Fallen (p. 124)

24. Face with rarely more than two facials; supra-alar not developed (Species Keyed under Psilopa).....*Helaeomyia* Cresson (p. 124)

Face with three or more closely set facials; lower portion flattened and wrinkled; deeply bifoveate above; supra-alar well developed.
Rhysophora robusta Cresson (p. 123)

25. Vein II closely approximate to costa beyond vein I; posterior crossvein with angular bend at middle, and its superior portion almost in continuous alignment with the ultimate section of vein IV.
Clanoneurum americana Cresson (p. 128)

Vein II and posterior crossvein normal.
Discomyza u-signata Cresson (p. 128)

Tribe Gymnopini

GYMNOPA Fallen

1820. Dipt. Suec., Oscin, p. 10.

Gymnopa bidentata Cresson

1926. *Gymnopa bidentata* Cresson, Trans. Amer. Ent. Soc., LII, p. 249.

A rather scarce western species ranging eastward to Michigan.

Gymnopa tibialis (Cresson)

1916. *Mosillus tibialis* Cresson, Entom. News, XXVII, p. 149.

A common species ranging southward to West Indies and Central America, but unknown to me from Canada except in southern British Columbia.

Key to the Species of Gymnopa

Face pruinose only in antennal foveae and in two depressed parafacies spots; tergite V with granulose or scabrous apical area but which it is not pruinose.....*bidentata* Cresson

Face distinctly pruinose on median area and largely on parafacies to near cheeks; scabrous area on tergite V pruinose.....*tibialis* (Cresson)

PARATHYROGLOSSA Hendel

1931. Bull. Soc. R. Ent. d'Egypte, XV, p. 68.

Parathyroglossa ordinata (Becker)

1896. *Athyroglossa ordinata* Becker, Berl. Ent. Zeit., XLI, p. 135.

A European species, scarce in the north and west portion of the United States, apparently confined to the Boreal and Transition Zones. Probably occurs in Canada.

ATHYROGLOSSA Loew

1860. Neue Beitr., VII, p. 12.

Athyroglossa glabra (Meigen)

1830. *Notiphila glabra* Meigen, Syst. Beschr. Eur. Zweifl. Ins., VI, p. 69.

A European species occurring rather rarely in the northern portion of the United States, also in Arizona and California, and probably in Canada.

Athyroglossa melanderi (Cresson)

1922. *Ochtheroidea melanderi* Cresson, Trans. Amer. Ent. Soc., XLVII, p. 399.

A rare species of general distribution except in the southeast.

Athyroglossa laevis (Cresson)

1918. *Ochtheroidea laevis* Cresson, Trans. Amer. Ent. Soc., XLI, p. 61.

A Neotropical species of which but one individual is known to me from Arizona.

Athyroglossa glaphyropus Loew

1878. *Athyroglossa glaphyropus* Loew, Zeit. f. Gesam. Naturw., LI, p. 197.

A rather common Austral species of general distribution, but rare northward.

Key to the Species of the Genus Athyroglossa

1. All tibiae black.....*glabra* (Meigen)
   Only fore tibiae black.....2
2. Halteres black or dark; face narrow, about one-quarter width of head; mesonotum granulose.....*granulosa* Cresson
   Halteres white or yellow.....3
3. Mesonotum shining or very weakly sculptured; face about one-quarter width of head, smooth, rather weakly convex; cheeks narrow. *laevis* (Cresson)
   Mesonotum subopaque with granulose scultpturing.....4
4. Cheeks narrow, about one-fifth height of head; face narrow, evenly convex, not prominent in profile.....*glaphyropus* Loew
   Cheeks broader; face broader, about one-third width of head, subgibbously prominent in profile.....*melanderi* (Cresson)

Tribe ATISSINI

HECAMEDE Haliday

1839. An. Nat. Hist., III, p. 224.

Hecamede albicans (Meigen)

1830. *Notiphila albicans* Meigen, Syst. Beschr. Eur. Zweifl. Ins., VI, p. 65.

A European species of which a few specimens have been seen from New York and Delaware.

GLENANTHE Haliday

1839. An. Nat. Hist., III, p. 404.

Glenanthe litorea Cresson

1925. *Glenanthe litorea* Cresson, Entom. News, XXXVI, p. 166.

A scarce species ranging northward east of the Rocky Mountains, and in Alaska.

ALLOTRICHOMA Becker

1896. Berl. Ent. Zeit., XLI, p. 121.

Allotrichoma simplex (Loew)

1861. *Discocerina simplex* Loew, Berl. Ent. Zeit., v, p. 354. (Cent., I, no. 92.)

The most common species of the genus and of general distribution except in the Lower Austral.

Allotrichoma lateralis (Loew)

1860. *Hecamede laterale* Loew, Neue Beitr., VII, p. 13.

A European species, rare in western coast states.

Allotrichoma atrilabris Cresson

1926. *Allotrichoma atrilabris* Cresson, Trans. Amer. Ent. Soc., LII, p. 252.

A rare eastern species.

Allotrichoma yosemite Cresson

1926. *Allotrichoma yosemite* Cresson, Trans. Amer. Ent. Soc., LII, p. 252.

A more common species of the Rocky Mountains and westward.

Allotrichoma slossonae new species

Similar to *A. abdominalis* (Williston) in its facial structure, but differing in being entirely whitish pruinose and with yellow legs, also differing in its numerous irregularly arranged mesonotal setulae.

This unique type appears to be somewhat teneral which may account for the general paleness; and its position on the card point precludes examination of the mouth parts.

Legs except hind tibia and apices of all tarsi, yellow. Wings lactaceous with yellow veins. Vestiture in general, white pruinose except on frons where it is more brownish, and the upper portion of the mesopleura is also brownish.

Ocellars distinctly in advance of the line of anterior ocellus and aligned with frontals and frontorbitals. Face prominently subcarinate as in *abdominalis*. Mesonotal setulae numerous indistinctly seriated. Mesonotal macrochaetae not strong but a presutural is evident. Scutellum uniformly setulose on dorsum, not in two series as in *abdominalis* nor as of any other known species of *Allotrichoma;* also an intermediate lateral of the scutellum near the apicals is also well developed. Otherwise not materially different from *abdominalis*.

Type.—Female; Biscayne Bay, Florida; (A. T. Slosson); [U.S.N.M., no. 56367].

Allotrichoma abdominalis (Williston)

1896. *Hecamede abdominalis* Williston, Trans. Ent. Soc. London, 1896, p. 398.

A Neotropical species occurring rarely in the Lower Austral of the Atlantic and Gulf States.

Key to the Species of the Genus Allotrichoma

1. Proboscis slender, genticulate with lanceolate labellum.....5
   Proboscis normal with fleshy labellum.....2
2. Clypeus shining black, contrasting with the pruinose face; mesopleura with a broad, rather sharply defined brown mark at dorsal margin.....4
   Clypeus pollinose, opaque, not contrasting with face; mesopleura, at most, with irregular, indistinctly defined brown mark.....3
3. Males;[4] genital appendage more or less setiform, with or without dilated tips.....*simplex* (Loew)
   Males; genital appendages rather spatulate and ciliate on their full length from base.....*lateralis* (Loew)
4. Eastern species with pale tarsi.....*atrilabris* Cresson
   Western species with dark tarsi.....*yosemite* Cresson
5. General color of vestiture chocolate brown to ovivaceous brown, more or less varied with whitish stripes and areas; mesonotal setulae distinctly seriated; legs mostly black.....*abdominalis* Williston
   General color white to gray; mesonotal setulae not seriated; legs mostly pale.....*slossonae* new species

PELIGNUS Cresson

1926. Trans. Amer. Ent. Soc., LII, p. 254.

Pelignus salinus new species

Similar to the European *Atissa durenbergensis* Loew, 1864, but more uniformly cinereous and with broader frons, face and cheeks.

Entirely opaque, densely cinereous to whitish pruinose. Palpi and tarsi yellow; halteres white. Frons, mesonotum and scutellum faintly ochraceous; wings obscured, lactaceous with pale veins.

Face at antennae about two-thirds width of vertex and about as broad as long; cheeks in width about one-third eye-height; arista with four short superior hairs; scutellum with rounded apex, slightly convex; costa II and III subequal in length.

Length, 1.75 mm.

Type.—Male; Saltair, Great Salt Lake, Utah; July 15; (J. M. Aldrich); [U.S.N.M., no. 21845].

Paratypes.—2 ♀; topotypical.

[4] The females of these two species are difficult to impossible to separate.

ATISSA Haliday

1839. An. Nat. Hist., III, p. 404.

Atissa humilis (Coquillett) new combination

1902. *Parephydra humilis* Coquillett, Jour. N. Y. Ent. Soc., X, p. 183.

A rare species found in South Dakota, Colorado, Arizona and New Mexico.

Atissa atlantica Cresson

1926. *Atissa atlantica* Cresson, Trans. Amer. Ent. Soc., LI, p. 253.

Known only by a few specimens from New Jersey.

Atissa litoralis (Cole) new combination

1912. *Allotrichoma litoralis* Cole, Rept. Laguna Marine Lab., I, p. 160.

A scarce western species.

Key to the Species of the Genus Atissa

1. Mesonotal setulae in six series between the intra-alars; dark, western species.....*litoralis* Cole
   Mesonotal setulae in four series.....2
2. Almost entirely whitish pruinose species; many setulae weak and pale; antennae and legs for the most part yellow.....*humilis* Coquillett
   Almost entirely brown to olivaceous species; all setulae black and well developed; antennae and legs for the most part black..*atlantica* Cresson

ATISSIELLA Cresson

1918. Trans. Amer. Ent. Soc., XLIV, p. 55.

Atissiella falsisetae new species

This species is distinguished from the other North American relatives by the sparsity of the mesonotal setulae and of which those in the sutural region are very long forming a conspicuous transverse series. Very similar to the Costa Rican *setulosa* Cresson, 1918, but more shining, the surface gloss not completely obscured by the brown vestiture. The facials are more bristle-like, not pale, and the secondary series of setae nearly as stout as the strongest of the primaries.

Antennae except dorsal surfaces, palpi and base of tarsi, pale, yellowish. Halteres yellow. Wings immaculate, brownish with dark veins; in certain aspects reflecting metallic blue and coppery.

Subopaque, sparsely brown to ochraceous pollinose, not entirely obscuring the surface gloss, but abdomen more shining. Head entirely opaque.

Head distinctly transverse; ocellar tumor subtuberculose; posterior ocelli but slightly removed; ocellars approximate, divergent, well caudad of line of anterior ocellus; frontorbital rather weak. Face about one half width of vertex, nearly as broad as long; primary series of two ventro-mesally inclined setae of which the most caudad is generally the smaller; secondary series of two to three ventro-laterally inclined setulae which are almost as stout as the primaries. Arista with about five superior, rather straight, well separated hairs, and about two, more appressed inferior hairs.

Mesonotal setulae rather sparse, in four well separated series, each series with a stronger bristle-like seta at the sutural region, which, with the strong supra-alars, forms a transverse series of six setae. Prescutellars well removed cephalad; humeral and presutural weak. Abdomen with noticeably longer setae at lateral and apical margins of tergites III and IV. Costa II not longer than III.

Length, .9 mm.

Type.—Male; Crum Creek at Swarthmore, Pennsylvania, June 19, 1910, (E. T. Cresson, Jr.); [A.N.S.P., no. 6622].

Atissiella mabelae Cresson

1926. *Atissiella mabelae* Cresson, Trans. Amer. Ent. Soc., LII, p. 253.

This species is known only by the type from Pennsylvania.

Atissiella pleuriseta new species

A species belonging to the group having the mesonotal setulae rather indistinctly arranged in six series, none forming a transverse row at the suture and in this respect allied to the European *Atissa kairensis* Becker, 1903.

Antennae for the most part, pale; more or less of the fore coxae and tarsi except apices yellow. Halteres white. Wings immaculate.

Opaque, densely pollinose, which is ochraceous on the frons, mesonotum and scutellum, becoming more grayish but not cinereous on face, lateral surfaces of thorax and on the legs; abdomen almost white.

Head slightly transverse in cephalic aspect. Posterior ocelli distinctly removed from vertex; ocellars well separated, parallel, and slightly caudad of line of anterior ocellus; orbitals relatively strong. Face distinctly longer than broad, with but one facial in primary series and a relatively strong dorso-laterally inclined seta at the extreme caudal portion and relatively near the buccal which is also near the oral margin; one or two minute ventrally inclined setulae, reminant of a secondary series, near parafacies, laterad of the median primary facial. A distinct groove just ventrad of the median

tuberosity extending ventrocaudally to lateral oral margin. Arista with six hairs superior curved hairs and small inferior hairs.

Mesonotum with numerous setulae arranged in five to six indistinct series, sometimes the series not discernible; no transverse sutural series of stronger setae and no supra-alar, but humeral and presutural well developed. Mesopleura with the cephalo-dorsal seta almost as strong as notopleurals. Abdomen without long marginal setae.

Type.—Male; Las Cruces, New Mexico; June 14, 1917; (J. M. Aldrich); [U.S.N.M., no. 56362].

Paratypes.—1 ♂, 1 ♀; topotypical, with same data.

Atissiella alkalinella new species

Similar to *pleuriseta,* but darker, the antennae, palpi and tarsi being dark brown to black, and the vestiture dark brown. The antennal arista is shorter and the hairs closer together, making a denser assemblage, the inferior hairs are practically absent. The primary series of facials contain two ventromesally inclined bristles, and the secondary series containing a few setulae dorsad and the usual dorsally inclined seta near the oral margin; sometimes these setulae are rather irregular. All the larger bristles are shorter than in *pleuriseta.* Thoracic setation similar to that of *pleuriseta,* but the prescutellars and the intra-alars are nearer the posterior margin. Costa II distinctly longer than III.

Length, .95 mm.

Type.—Male; Soda Lake near Hazen, Nevada; July 13, 1901; (J. M. Aldrich; at fresh water seepage); [U.S.N.M., no. 56363].

Paratypes.—1 ♀; topotypical, with same data. 1 ♀; Soap Lake, Grant County, Washington; July 24, 1919; (A. L. Melander).

Key to the Species of the Genus Atissiella

1. Mesonotal setulae relatively sparse, in four well separated series; primary series of facials consisting of only two ventrally inclined setae.....3
   Mesonotal setulae numerous, in about six closely set series; primary series of facials consisting of one or two ventrally inclined setae and a dorsally inclined seta.....2
2. Facial series with but one ventrally inclined seta; costa II not longer than III.....*pleuriseta* new species
   Facial series with two such setae; costa II distinctly longer than III. *alkalinella* new species
3. Mesonotum with a transverse series of about six long setae at sutural region; wings immaculate.....*falsisetae* new species
   Mesonotum without such transverse series of setae; wings maculate. *mabelae* Cresson

Tribe Discocerinini

HYDROCHASMA Hendel

1936. Ann. Naturh. Mus. Wien, xlvii, p. 101.

Hydrochasma capax Cresson

1938. *Hydrochasma capax* Cresson, Rev. d. Entom., Rio d. Janeiro, viii, p. 26.

A Neotropical species rarely seen, in Southern California and Arizona.

Hydrochasma leucoprocta (Loew) new combination

1861. *Discocerina leucoprocta* Loew, Berl. Ent. Zeit., v, p. 355. (Cent. i, no. 93.)

A common species of general distribution.

Hydrochasma incisa (Coquillett) new combination

1902. *Discocerina incisa* Coquillett, Jour. N. Y. Ent. Soc., x, p. 182.

A Neotropical form of the above, rarely seen, from Florida.

Hydrochasma buccata (Cresson) new combination

1930. *Hecamedoides buccata* Cresson, Entom. News, xli, p. 78.

Rather a rare species from the east coast states but also seen from Michigan, Kansas, Wyoming and New Mexico.

Key to the Species of the Genus Hydrochasma

1. Parafacies setulae black and few in number; facialia but slightly diverging ventrad; uppermost facial with distinct shining basal papilla; cheeks very broad, about one-half height of head.....*buccata* (Cresson)
   Parafacies setulae pale and difficult to see; facialia distinctly to strongly diverging ventrad; uppermost facial without distinct basal papilla.....2
2. Mouth opening very large; head subglobose, very broad; fore femoral comb of numerous, minute spinules on anterior margin...*capax* Cresson
   Mouth opening not unusually large; head more flattened in profile; fore femoral comb of several (2 to 6) spinules on posterior margin.....3
3. Parafacies noticeably white in contrast with the yellowish medifacies and with the dark facialia; tergites III and IV usually with lateral cinereous wedges.....*incisa* (Coquillett)
   Parafacies and facialia not noticeably contrasting with medifacies; tergites without lateral cinereous wedges.....*leucostoma* (Loew)

POLYTRICHOPHORA Cresson

1924. Entom. News, xxxv, p. 161.

Polytrichophora agens Cresson

1924. *Polytrichophora agens* Cresson, Entom. News, xxxv, p. 161.

A scarce species occurring in the Lower Austral of the Atlantic and Gulf States.

Polytrichophora orbitalis (Loew)

1861. *Discocerina orbitalis* Loew, Berl. Ent. Zeit., v, p. 354. (Cent. I, no. 91.)

Not a common species of the eastern and central states.

Polytrichophora setigera Cresson

1916. *Polytrichophora setigera* Cresson, Entom. News, xxvii, p. 148.

Probably a subspecies of *orbitalis* and representing it in the west. Rare.

Polytrichophora conciliata Cresson

1920. *Polytrichophora conciliata* Cresson, Entom. News, xxxv, p. 161.

Known only from the Atlantic and Gulf coastal states and Michigan. The most common species of the genus.

Key to the Species of the Genus Polytrichophora

1. Large (3 mm.) species; cheek at least about twice as broad as antenna III; no anteroflexor comb, but a series of very long fine setae on postflexor margin of fore femora.....*agens* Cresson
   Smaller species; cheek at most not broader than antenna III.....2
2. Parafacies not dilating ventrad to broad cheek; mesonotal setulae not seriated; no noticeable acrostichals; no anteroflexor comb, but a series of several stout postflexor spines on fore femur.....*orbitalis* (Loew)
   Parafacies distinctly dilating ventrad to broad cheek; mesonotal setulae usually seriated medianly, with several pairs of long postsutural acrostichal setae; fore femur with an anteroflexor comb of minute spinules and few setae on postflexor margin.....*conciliata* Cresson

DISCOCERINA Macquart

1835. Hist. Nat. Ins., Dipt., II, p. 527.

The species of *Discocerina,* as distinct from those of *Ditrichophora,* have the notopleural depression more or less setulose [5] and

[5] Because of the shining to polished condition of the surface of some of the species, these setulae are difficult to see and their apparent absence may lead one astray, so that the position of the anterior notopleural must be utilized.

the anterior notopleural bristle is situated about in the middle of the depression, ventrad of the dorsal sutural angle, noticeably closer to the posterior bristle than to the humeral. In *Ditrichophora* the depression is bare and the anterior notopleural is situated more cephalad, in the anterior angle, closer to the humeral.

Of this genus there have been proposed two subgenera by Hendel viz. *Gymnoclasiopa*[6] and *Lamproclasiopa*.[7] On the basis of the above mentioned notopleural characteristics, the former falls under *Ditrichophora* and the latter under *Discocerina*. The utilization of these entities as subgenera, leaves a few species heretofore considered as belonging to *Ditrichophora* which will not fit into either, and for these I have here proposed a new subgenus.[8]

Subgenus **Discocerina**

Discocerina (Discocerina) trochanterata Cresson

1939. *Discocerina trochanterata* Cresson, Notulae Nat., no. 38, p. 3.

A rare California species.

Discocerina (Discocerina) obscurella (Fallen)

1813. *Notiphila obscurella* Fallen, K. Svenska Vet. Akad., Handl., xxxiv, p. 251.

One of the most abundant species of the present subfamily and of general Holarctic distribution.

Discocerina (Discocerina) flavipes Cresson

1941. *Discocerina flavipes* Cresson, Entom. News, li, p. 35.

Possibly only a variety of *obscurella,* known only from California.

Subgenus **Lamproclasiopa** Hendel

Discocerina (Lamproclasiopa) obscura Williston

1896. *Discocerina obscura* Williston, Trans. Ent. Soc. London, 1896, p. 397.

A Neotropical species, but ranges northwards in the Atlantic States to New York. Rare.

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[6] Konowia, ix, p. 136, 1930. [Genotype: *Notiphila plumosa* Fallen.]

[7] Rev. d. Entom., Rio d. Janeiro, iii, p. 79. [Genotype: *Discocerina facialis* Hendel.]

[8] *Gymnoclasiopa* cannot be considered, because its genotype, *Discocerina plumose* (Fallen, 1823) has the notopleura bare and the notopleurals removed from each other, a character of *Ditrichophora.*

Discocerina (Lamproclasiopa) turgidula Cresson

1940. *Discocerina turgidula* Cresson, Notulae Nat., no. 38, p. 3.

A rare western species from Nevada and California.

Discocerina (Lamproclasiopa) brunneonitens Cresson

1940. *Discocerina brunneonitens* Cresson, Notulae Nat., no. 38, p. 4.

A rare species known only from Illinois, Florida and Mississippi.

Subgenus **Basila** new subgenus

Ditrichophora, heretofore basically characterized by possessing only two facials in the primary series instead of three as in *Discocerina* [9] is now distinguished by the more definite notopleural features above mentioned. Such treatment will remove from that genus, several species having the more *Discocerina* affinities, and the present subgenus is proposed for such assemblage.

TYPE-SPECIES: *Discocerina* (*Basila*) *nadineae* (as *Ditrichophora nadineae* Cresson, 1925).

Macrochaetae strong. Head disciform with sharp concaved vertex and concaved occiput. Eyes large, rather elliptical, with no posterior orbit visible dorsad, in profile. Frons transverse; postocellars much weaker than ocellars, strongly divergent. Antennal foveae deep, well defined at upper facial bristles; only two equally strong facials in primary series, although one or more smaller setae may be present in the series ventrad, parafacies bare. Antennae as in *Discocerina.* Mesonotal setulae irregular; notopleura setulose, the two notopleural bristles approximate, the anterior one situated nearer the posterior one than to the humeral. Otherwise similar to typical *Discocerina.*

Discocerina (Basila) nadineae Cresson

1926. *Discocerina nadineae* Cresson, Entom. News, XXXVI, p. 166.

A rare species known only from California.

Key to the Species of the Genus Discocerina

1. Parafacies with series of down-curved setulae (Subgenus *Discocerina*) . . 5
   Parafacies bare 2
2. Facial series of only two equally long bristles (Subgenus *Basila*). *nadinae* (Cresson)
   Facial series of three or more equally long bristles (Subgenus *Lamproclasiopa*) 3

[9] This character, although a variable one and poorly defines the generic limits, is quite a help in distinguishing most of the species of the two genera.

3. Parafacies narrow, pale, contrasting with dark medifacies.....4
Parafacies broad, densely cinereous or white, not contrasting with more or less pollinose medifacies; and strongly dilating ventrad to broad cheeks.....*turgidula* Cresson
4. Shining species; face much narrower than frons; orbits strongly flaring ventrad; four to five long closely set facials.....*brunneonitens* Cresson
More obscure species; face not much narrower than frons; orbits not greatly flaring ventrad; three normally set facials..*obscura* (Williston)
5. Parafacies not noticeably differentiating from medifacies either in color of ground or vestiture; hind trochanters of male with a long caudal seta. *trochanterata* Cresson
Parafacies contrastingly paler in ground color, the sparser vestiture augmenting this contrasity; hind trochanters without such seta.....6
6. Coxae and femora almost entirely black.....*obscurella* (Fallen)
Coxae and femora almost entirely pale.....*flavipes* Cresson

HECAMEDOIDES Hendel

1917. Deut. Ent. Zeit., 1917, p. 41.

Hecamedoides glaucella (Stenhammar)

1844. *Clasiopa glaucella* Stenhammar, K. Svenska Vet. Akad., Handl., 1843, p. 233.

A European species of Boreal and Transition distribution in North America. Rather scarce.

DICLASIOPA Hendel

1917. Deut. Ent. Zeit., 1917, p. 42.

Diclasiopa lacteipennis (Loew)

1862. *Discocerina lacteipennis* Loew, Monogr. No. Amer. Dipt., I, p. 145.

A rather common species occurring from Massachusetts to Washington and Virginia to New Mexico, but not known from the more southeastern states.

DITRICHOPHORA Cresson

1914. Entom. News, XXV, p. 159.

Subgenus **Ditrichophora**

Ditrichophora (Ditrichophora) simiaceps Cresson

1940. *Ditrichophora simiaceps* Cresson, Notulae Nat. no. 38, p. 6.

A rare species known only from Indiana and Washington.

Ditrichophora (Ditrichophora) lenis Cresson

1940. *Ditrichophora lenis* Cresson, Notulae Nat., no. 38, p. 5.

A very rare species known only from Washington.

Ditrichophora (Ditrichophora) atrata Cresson

1940. *Ditrichophora atrata* Cresson, Notulae Nat., no. 38, p. 7.

A rare species, known typically only from Oregon and California, but a variant occurs in New York, Wisconsin and Montana.

Ditrichophora (Ditrichophora) occidentalis new species

A large western species very similar to *Ditrichophora exigua* Cresson but the tarsi (rarely the hind ones pale) and antennae are entirely black. In this respect it simulates *atrata* and has been misidentified as that species, but the mesonotum here is distinctly pollinose, almost obscuring all gloss.

Entirely black except the white halteres; rarely hind tarsi pale. Opaque to subopaque or almost shining on face and abdomen; dorsal surfaces brown pollinose, becoming sparingly grayish laterad and ventrad. Face almost destitute of any vestiture.

Head but slightly broader than high. Frons broader than in *exigua*, almost quadrate with orbits parallel. Face almost as broad as vertex; lower medifacies transverse; parafacies greatly dilated ventrad to very broad cheeks which are at least twice as broad as length of third antennal segment.

Mesonotal setulae irregular. Fore femoral postflexor comb almost obsolete; the spinules irregularly developed. Second costal section distinctly longer than third.

Length, 1.6 to 2.3 mm.

Type.—Male; Longmire, Pierce Co., Washington; June 27, 1935; (A. L. Melander); [A.N.S.P., no. 6623].[10]

Paratypes.—2 ♂; with same data. 1 ♂, 3 ♀; Montesano, Gray's Harbor Co., Washington; July 19, 1917; (A. L. Melander).

Ditrichophora (Ditrichophora) exigua Cresson

1924. *Ditrichophora exigua* Cresson, Entom. News, xxv, p. 159.

A not common eastern species apparently confined to the Transition Zone, but not west of Michigan.

Ditrichophora (Ditrichophora) valens new species

Very similar to the European *Discocerina calceata* (Meigen) but less shining and the vestiture more grayish. Allied to *exigua*

[10] Dr. Melander has kindly placed the type of this and the three following species in the Academy's collection.

Cresson but more robust and the face comparatively densely cinereous, thus augmenting the flatness of the face; and furthermore, the third costal section is noticeably shorter.

Pale, yellow to orange: base of antennae III sometimes, extremities of tibiae sometimes, tarsi except apices. Halteres white. Wings veins somewhat diluted.

Frons opaque gray becoming brown at vertex. Face densely cinereous including parafacies and cheeks. Mesonotum rather shining but grayish to brown, pollen always more or less dense although more sparse cephalad, becoming grayish laterally and on pleura. Scutellum as mesonotum. Abdomen mostly shining but more obscured to almost opaque brown on dorsum basad.

Structure in general as *exigua*. Head as broad as high. Frons as broad as, or slightly broader than, long; in profile strongly convex, the frontofacial conjunction slightly oblique. Face very broad, about two-thirds as broad as vertex; longer than broad; in profile rather evenly convex but more prominent at upper facial; foveae and carina well developed but not sharply defined; medifacies area distinctly transverse; upper facials not on distinct papillae; parafacies strongly dilated ventrad to cheeks, the later, about as broad as length of antennae III. Arista with six to seven hairs. Mesonotal setulae indistinctly seriated. Cilia of costa uniform; costa II at least twice as long as III.

Length, 2 to 3 mm.

Type.—Male; Tacoma, Washington; May 27, 1917; (A. L. Melander); [A.N.S.P., no. 6629].

Paratypes.—1 ♂, 1 ♀; Walla Walla, Mill Creek, Washington; VI 24, 1921; VII 2–8, 1922. 1 ♂; Husum, Washington; VI 28, 1917. 1 ♂; Pullman, Washington; VI 10, 1911. 1 ♂, 1 ♀; Hoods Canal, Potlatch, Idaho; VII 28, 1917; (all A. L. Melander).

Ditrichophora (Ditrichophora) lugubris Cresson

1940. *Ditrichophora lugubris* Cresson, Notulae Nat., no. 38, p. 7.

A very rare species known only from Oregon and California.

Subgenus **Gymnoclasiopa**

Ditrichophora (Gymnoclasiopa) tacoma Cresson

1924. *Ditrichophora tacoma* Cresson, Entom. News, xxxv, p. 160.

A scarce northwestern species.

Ditrichophora (Gymnoclasiopa) parilis Cresson

1924. *Ditrichophora parilis* Cresson, Entom. News, xxxv, p. 160.

A scarce species occurring in the New England States.

Ditrichophora (Gymnoclasiopa) subnublia Cresson

1940. *Ditrichophora subnubila* Cresson, Notulae Nat., no. 38, p. 6.

Very scarce and seen only from Alaska and Washington.

Ditrichophora (Gymnoclasiopa) montana new species

The flattened lower portion of the face, which in the males is sericeous and yellow, suggests the European *Clasiopa dimidiapennis* Strobl, 1893, but the present species shows no infumation of the wings. The males are readily distinguished from that sex of all the other known American species related to *Ditrichophora pulchella* (Meigen) by the brown humeral-notopleural region, broad rather flattened golden yellow sericeous face and the entirely yellow antennae. It is not to be confused with *pulchella* in the latter respect. The females are distinguished by their opaque, cinereous vestiture and yellow fore tibiae.

Pale, yellow are: the antennae, palpi, fore coxae, fore tibia for the most part, all tarsi except apices. Halteres yellowish white. Wings clear with pale veins. The yellows in the females are not so pale as in the males.

Vestiture mostly cinereous; of the frons yellowish cephalad; face of male golden, of female yellow, sericeous; linear parafacies and the cheeks are lighter. Mesonotum and scutellum of female somewhat brownish. Humeri presutural calli, notopleura of male, brown in contrast with the cinereous mesonotum; this brown color sometimes extending onto the mesopleura. Abdomen more or less brownish, becoming shining black laterad and apicad. Legs mostly cinereous.

Species large. Head not, or but slightly, broader than high. Frons rather quadrate. Face not more narrower than frons; in profile, evenly convex; foveae and carina very weak, scarcely differentiated, partly due to the dense sericeous vestiture; lower mesofacies weakly convex, almost flat, strongly transverse; parafacies linear, scarcely differentiated; lower facial bristle weak. Cheeks at most as broad as antenna III; spine scarcely as long as III.

Mesonotal setulae irregular; presutural very weak. Scutellar apicals very long, almost three times as long as scutellum; laterals almost as long as apicals.

Wings long and narrow; costa II two to three times as long as III. Setulae of legs weak; fore femoral comb of about six short setae, no spinulae.

Length, 2.5 to 3 mm.

Type.—Male; Avalanch Lake, Glacier National Park, Montana; July 14, 1935; (A. L. Melander); [A.N.S.P., no. 6628].

Paratypes.—1 ♀; topotypical. 1 ♀; Lake MacDonald, Glacier National Park; VI 13, 1935. 1 ♂; Hidden Valley, Rocky Mountain National Park, Colorado; VIII 3, 1934. 1 ♀; Estes Park, Colorado; VII 13, 1934. 1 ♀; Emeral Lake British Columbia; VII 30, 1938; (all A. L. Melander).

Ditrichophora (Gymnoclasiopa) pulchella (Meigen)

1830. *Notiphila pulchella* Meigen, Syst. Beschr. Eur. Zweifl. Ins., VI, p. 70.

A European species occurring rather scarcely east of the Rocky Mountains northward.

Ditrichophora (Gymnoclasiopa) cana Cresson

1940. *Ditrichophora cana* Cresson, Notulae Nat., no. 38, p. 7.

A scarce species occurring in the west coast states.

Ditrichophora (Gymnoclasiopa) canifrons Cresson

1926. *Ditrichophora canifrons* Cresson, Trans. Amer. Ent. Soc., LII, p. 250.

A rare eastern species, from Quebec, New York and Pennsylvania.

Ditrichophora (Gymnoclasiopa) argyrostoma (Cresson)

1916. *Discocerina argyrostoma* Cresson, Entom. News, XXVII, p. 149.

A very common western species, seldom occurring east of the Rocky Mountains.

Key to the Species of the Genus Ditrichophora

1. Face rather flattened, the foveae not always sharply defined ventrad; facial series of bristles very close to parafacies, the uppermost not appreciably more removed mesad than the lower one (Subgenus *Gymnoclasiopa*) 8

   Face rather prominent at upper facials, sometimes almost transversely carinate; antennal foveae generally sharply defined ventrad (Subgenus *Ditrichophora*) 2

2. Halteres black. Totally shining species with little or no trace of vestiture; frons with two orbitals; face subgibbous with deeply excavated antennal foveae; wings clear with pale veins and costa II not longer than III ..... *simiaceps* Cresson

   Halteres knob white or whitish 3

3. Frons with two orbitals, the anterior one almost one-half as long as ocellars and situated well cephalad. Entirely black opaque species (except halteres); frons and mesonotum brown pollinose; face black, at most slightly brown pollinose, with definite antennal foveae; tarsi black.....*lugubris* Cresson

   If two frontorbitals present, the anterior one very minute and appressed.....4

4. Frons more or less shining including ocellar triangle, pollen sparse or absent. Small (1.5 mm.) shining, sparsely pollinose species; face destitute of dense pollen, with prominent medifacies; tarsi and extremities of tibiae somewhat pale; costa II not much longer than III. *lenis* Cresson

   Frons entirely opaque or at most subopaque anteriorly.....5

5. Mesonotum opaque or gloss but slightly evident except where pollen is denuded.....7

   Mesonotum shining, the pollen sparse or absent; antennae and palpi black or base of former diluted, but rarely latter brown.....6

6. Face cinereous. Somewhat shining species, the sparse pollen not obscuring the gloss, but which is more dense and cinereous on notopleura and mesopleura; face broad and convex; costa II about, or more than twice, as long as III.....*valens* new species

   Face black or sparingly dark pollenose. Somewhat shining entirely black species, including tarsi; face prominent at upper facial; costa II not much longer than III.....*atrata* Cresson

7. Tibiae entirely, and all tarsi as well as antennae, black (rarely hind tarsi pale). Small subopaque entirely black species (except halteres); face prominent; mesonotal setulae irregular....*occidentalis* new species

   Extremities of tibiae and most of tarsi as well as base of antenna III more or less pale. Small rather opaque species with abdomen more shining; mesonotal setulae sometimes distinctly seriated; costa II not or but little longer than III.....*exigua* Cresson

8. Two frontorbitals present, the anterior one almost one-half as long as ocellars and situated well cephalad.....13

   If two frontorbits are present the anterior one is very minute and appressed.....9

9. Antennae and palpi black. A large (2 to 3 mm.) shining species with sparse brown vestiture on frons and mesonotum, but notopleura humeri and pleura polished, destitute of pollen; face with broad flattened densely cinereous to niveous medifacies; costa II more than twice as long as III.....*argyrostoma* (Cresson)

   Antennae pale, yellow to brown; palpi black. Subopaque species, the vestiture not totalling obscuring the gloss on thorax; face not prominent; tibiae black; costa II at least twice as long as III..*parilis* Cresson

   Antennae and palpi, pale; face broad rather flattened.....10

10. Tibiae black, rarely extremities diluted.....12
Tibiae mostly pale, sometimes fore pair entirely pale.....11
11. Mesonotum fully densely opaque or gloss just discernible. Large opaque densely cinereous species with abdomen shining black laterally; mesonotum very convex with setulae irregular; fore tibiae entirely pale; face broad and convex.....*montana* new species
Thorax mostly shining or subopaque. Slender, mostly shining species with mesonotum subopaque cinereous medianly becoming more shining on pleura; frons of male densely cinereous; face weakly convex, sericeous golden to niveous; mesonotum rather flattened with setulae somewhat seriated; entire antennae and fore tibiae generally conspicuously yellow.....*pulchella* (Meigen)
12. Thorax shining, sparingly brown pollinose. Shining, sparingly pollinose species; face very broad; fore tibiae somewhat extensively pale at extremities.....*tacoma* Cresson
Mesonotum densely opaque but gloss slightly discernible; frons and pleura more dense; face sericeous, niveous to yellowish, broad; antennae brown to ochre.....*subnubila* Cresson
13. Antennae entirely (except apex of III), extremities of tibiae and all tarsi except apices, pale, yellowish. Large densely cinereous species; face and pleura black, shining, the latter sharply contrasting with notopleura and humeri; face flattened or slightly convex; arista with 7 to 8 hairs; wings lactaceous.....*canifrons* Cresson
Antennae and tibiae black; arista with 5 to 6 hairs; wings not lactaceous; otherwise same.....*cana* Cresson

Tribe Psilopini

RHYSOPHORA Cresson

1924. Entom. News, xxxv, p. 159.

Rhysophora robusta Cresson

1924. *Rhysophora robusta* Cresson, Entom. News, xxxv, p. 159.

A rare species of the Atlantic and Gulf States ranging from Canada to Louisiana.

TRIMERINOIDES Cresson

1925. Entom. News, xxxvi, p. 165.

Trimerinoides adfinis (Cresson)

1922. *Trimerina adfinis* Cresson, Entom. News, xxxiii, p. 137.

A rare species known only from British Columbia and Idaho.

TRIMERINA Macquart

1835. Hist. Nat. Ins., Dipt., II, p. 528.

Trimerina madizans (Fallen)

1913. *Notiphila madazins* Fallen, K. Svenska Vet. Akad., Handl., XXXIV, p. 252.

A European species occurring in the New England States. Rare.

HELAEOMYIA Cresson

1941. Entom. News, LII, p. 35.

Helaeomyia nigra (Williston)

1896. *Psilopa nigra* Williston, Trans. Ent. Soc. London, 1896, p. 393, pl. 13, fig. 139.

Primarily a Neotropical species ranging into the Gulf States. Rare.

Helaeomyia petrolei (Coquillett)

1899. *Psilopa petrolei* Coquillett, Can. Entom., XXXI, p. 8.

The petroleum or oil fly of California. Rare.

PSILOPA Fallen

1823. Dipt. Suec., Hydrom., p. 6.

Psilopa leucostoma (Meigen)

1830. *Notiphila leucostoma* Meigen, Syst. Beschr. Eur. Zweifl. Ins., VI, p. 68.

A European species occurring in the northern and western states. Rare.

Psilopa olga Cresson

1922. *Psilopa olga* Cresson, Entom. News, XXXIII, p. 137.

A scarce western and west Canadian species.

Psilopa compta (Meigen)

1830. *Notiphila compta* Meigen, Syst. Beschr. Eur. Zweifl. Ins., VI, p. 68.

An abundant species of general distribution, originally described from Europe; however not known from the southeastern states.

Psilopa pulchripes Loew

1878. *Psilopa pulchripes* Loew, Zeit. f. Gesam. Wissen., Berlin, LI, p. 197.

A Neotropical species ranging into the Gulf States and those along the Mexican boundary. Rare.

Psilopa dupla Cresson

1940. *Psilopa dupla* Cresson, Notulae Nat., no. 38, p. 2.

A rather scarce Austral species.

Psilopa flava Coquillett

1900. *Psilopa flava* Coquillett, Can. Entom., XXXII, p. 33.

The only generally pale species of the family known from North America. Very rare, and known only from the Atlantic and Gulf States.

Psilopa aeneo-nigra Loew

1878. *Psilopa aeneo-nigra* Loew, Zeit. f. Gesam. Wissen., Berl., LI, p. 196.
1904. *Psilopa fulvipennis* Hine, Ohio Naturl., IV, p. 64. (New Syn.)

A rare species occurring in the Atlantic and Gulf States.

Key to the Species of Psilopa and Allied Genera

1. Yellow to tawny species with strong setation.....*flavida* Coquillett
   Black species.....2
2. Halteres black.....*Plagiopsis*
   Halteres white.....3
3. Coxae and legs yellow; face of male sericeous white..*leucostoma* (Meigen)
   Coxae and femora black.....4
4. Mesonotum subopaque, granulose; antennae somewhat elongate.
   aeneo-nigra Loew
   Mesonotum smooth, more or less shining; antennae normal.....5
5. Legs entirely black; face most prominent above upper facials.
   Helaeomyia petrolei (Coquillett)
   At least bases of tarsi pale.....6
6. Face noticeably prominent at upper facials; medifacies wrinkled; antennae mostly black.....*Helaeomyia nigra* (Williston)
   Face not prominent or but slightly so, smooth and sometimes polished...7
7. Fore tibiae and their tarsi pale; face flattened, at most with weak antennal foveae, the single pair of facials cruciate and very low; antennae yellow.
   compta (Meigen)
   Fore tibiae black; face more or less convex with facials comparatively high.....8
8. Antennae black; face with rather distinct antennal foveae; two pairs of facials generally present.....*olga* Cresson
   Antennae mostly yellow; face convex, polished, the single pair of facials rather high; basal segment of fore tarsi white.....9

♀. The two basal segments of fore tarsi white, the three apicals black. *dupla* Cresson

Only the basal segment white, the four apicals dark.....*pulchripes* Loew

LEPTOPSILOPA Cresson

1922. Entom. News, XXXIII, p. 136.

Leptopsilopa similis (Coquillett)

1900. *Psilopa similis* Coquillett, Can. Entom., XXXII, p. 33.

A Neotropical species ranging northward in the Gulf and Atlantic States. Rare.

Leptopsiolpa atrimana (Loew)

1878. *Psilopa atrimana* Loew, Zeit. f. Gesam. Naturw., LI, p. 197.

A rather common eastern species but more abundant northward.

Leptopsilopa nigrimana (Williston)

1896. *Psilopa nigrimana* Williston, Trans. Ent. Soc. London, 1896, p. 393.

A Neotropical species not as yet known from the United States but very likely to be found in the Gulf States.

Leptopsilopa varipes (Coquillett)

1900. *Psilopa varipes* Coquillett, Can. Entom., XXXII, p. 33.

A rather common species in the Pacific Coast States.

Key to the Species of the Genus Leptopsilopa

1. Fore coxae pale.....3
   Fore coxae black; wings with posterior crossvein clouded.....2
2. All femora mostly black; mid and hind tibiae and their tarsi pale. *varipes* (Coquillett)
   Mid and hind legs entirely yellow.....*atrimana* (Loew)
3. Mid and hind femora blackened; wings practically immaculate. *nigrimana* (Williston)
   Mid and hind femora and fore femora except apices, pale; wings with a large median cloud, and a spot at end of vein II....*similis* (Coquillett)

PLAGIOPSIS Cresson

1936. Trans. Amer. Ent. Soc., LX, p. 201.

Plagiopsis skinneri (Cresson)

1922. *Psilopa skinneri* Cresson, Entom. News, XXXIII, p. 136.

I have seen but one specimen, from Florida, for our record.

Plagiopsis hinei (Cresson)

1922. *Psilopa hinei* Cresson, Entom. News, XXXIII, p. 135.

Not scarce in the Atlantic and Gulf States.

Plagiopsis aciculata (Loew)

1862. *Psilopa aciculata* Loew, Monog. Dipt. N. Amer., I, p. 142.

This species has been reported from Georgia and Louisiana, but I have seen but one individual for our record, from Alabama.

Key to the Species of the Genus Plagiopsis

1. Ocellars situated cephalad of the posterior ocelli; halteres white. *Psilopa aeneo-nigra* Loew
   Ocellars situated between posterior ocelli; halteres blackish.....2
2. Proclinate frontorbital minute; scutellum flattened, distinctly roughened; face smooth, polished, almost vertical in profile.....*aciculata* (Loew)
   Proclinate frontorbital well developed; face rather flattened, subopaque..3
3. Face, mesonotum and scutellum roughened.....*hinei* (Cresson)
   Face, mesonotum and scutellum shining, smooth or very weakly sculptured.....*skinneri* (Cresson)

CEROPSILOPA Cresson

1917. Entom. News, XXVIII, p. 340.

Ceropsilopa dispar Cresson

1922. *Ceropsilopa dispar* Cresson, Entom. News, XXXIII, p. 135.

A few individuals seen from California.

Ceropsilopa mellipes (Coquillett)

1900. *Psilopa mellipes* Coquillett, Proc. U. S. Nat. Mus., XXII, p. 260.

Several individuals seen from Florida and Texas.

Ceropsilopa coquilletti Cresson

1922. *Ceropsilopa coquilletti* Cresson, Entom. News, XXXIII, p. 136.

The most common species within our limits, found in the Atlantic and Gulf States from Maryland to Texas, and California.

Ceropsilopa staffordi Cresson

1925. *Ceropsilopa staffordi* Cresson, Entom. News, XXXVI, p. 166.

Found only in the Gulf States. Rare.

Ceropsilopa nasuta Cresson

1917. *Ceropsilopa nasuta* Cresson, Entom. News, XXVIII, p. 341.

A few individuals seen from Florida.

Ceropsilopa adjunta Cresson

1925. *Ceropsilopa adjunta* Cresson, Entom. News, XXXVI, p. 165.

A few individuals seen from Florida.

Key to the Species of the Genus Ceropsilopa

1. Femora mostly black; antennal spine small to minute.....5
   Femora and tibiae yellow.....2
2. Face entirely opaque, cinereous; antennal spine minute..*staffordi* Cresson
   Face shining, without any vestiture except sometimes on parafacies.....3
3. Face narrow, wrinkled, longitudinally obtuse carinate; antennal spine small to minute.....*coquilletti* Cresson
   Face broader, smooth, evenly convex, at most slightly prominent at mid profile; antennal spine long.....*mellipes* (Coquillett)
4. Face rather narrow; obtusely carinate, prominent above facials; frons not depressed; tibiae mostly pale; antennae very long; arista with 11 hairs. *nasuta* Cresson
   Face rather abruptly subgibbosely prominent above facials; frons not or but slightly depressed at antennae; tibiae mostly pale; antennae short, segment III not twice as long as II; arista with 8 hairs. *adjunta* Cresson
   Face rather broad, evenly convex; frons strongly depressed above antennae; tibiae mostly black; antennae long, segment III more than twice as long as II; arista with about six hairs.....*dispar* Cresson

Tribe DISCOMYZINI

Discomyza u-signata Cresson

1926. *Discomyza u-signata* Cresson, Trans. Amer. Ent. Soc., LII, p. 250.

A species easily recognized by the labyrinthine white pollinose markings on the face. Known only by a few specimens from Texas.

Clanoneurum americana Cresson

1940. *Clanoneurum americana* Cresson, Notulae Nat., no. 38, p. 1.

Easily recognized by the peculiar venation. A comparatively scarce species occurring in saline environments of the Atlantic and Gulf States, California, Arizona and Utah.

MISCELLANEOUS STUDIES IN THE COLEOPTERA, NO. 6[1] (MELYRIDAE AND TENEBRIONIDAE)

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I. New Species of Melyridae and Tenebrionidae

The following new species have been submitted to me for study: An interesting species of *Trichochrous* Motsch, received from the Entomological Laboratory, Natural History Museum, Balboa Park, San Diego, California. Three Tenebrionid species, namely; A new species of *Triorophus* Lec. and an *Eleodes* Esch. from Nevada, submitted by Mr. Ira La Rivers, and a *Blapstinus* Latr. collected in Death Valley, Inyo County, California, by Dr. E. C. Vandyke. The species may now be described as follows:

Trichochrous nevadensis new species

Nevadensis has to be distinguished from *subcalvus, funebris* and *vittiger* of Casey, as well as *subvittiger* Blaisdell. In *subcalvus* and *nevadensis* the distribution of the cinereous and darker pubescence form a similar pattern of maculation. In *subcalvus* the pronotum is transversely oval and evenly convex; the body is less elongate and the pubescence more abundant; type locality Southern California at San Diego. The species also occurs in the vicinity of Mokelumne Hill, Calaveras County, and in Fresno County (Sierra National Forest?), California. In *nevadensis* the pronotal sides are more prominent posteriorly and somewhat convergent apically (viewed from above); the disk appears more convex and rather more declivous antero-laterally.

Funebris is without metallic luster; pronotum more transverse and widest behind the middle, pubescence moderately dense, re-

[1] No. 1. Can. Ent., LIII, pp. 129–132, (June, 1921). No. 2. Pan-Pacif. Ent., III, pp. 163–168, (April, 1927). No. 3. Pan-Pacif. Ent., VI, pp. 21–25, (July, 1929). No. 4. Pan-Pacif., VI, pp. 57–62, (Oct., 1929). No. 5. Trans. Amer. Ent. Soc., LXIII, pp. 127–145, (June 29, 1937).

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clined and blackish, generally coarser and cinereous laterally; on the elytra the pale hairs occur along the suture and at the sides, especially toward base, where they diffuse inward in basal two-fifths; the lateral pronotal fimbriae are short. The species occurs in Colorado (Rocky Mountains). In *nevadensis* the pale hairs of the elytra form a well defined sutural stripe; at base they occur only on the margin and scutellum.

In *vittiger* the legs are rufous throughout, the pubescence longer, coarser, less decumbent and more abundant. The subsutural vitta of each elytron is less developed and variable. The species occurs in New Mexico.

Subvittiger has a more abundant cinereous pubescence, and the elytral vittae are more or less obsolete; body smaller, legs rufous.

In form *nevadensis* is elongate oblong-oval, about two and one-fourth times as long as wide. Color black, with a more or less aeneous tinge; tibiae and tarsi rufo-testaceous. Pubescence fine, decumbent and brownish on the pronotal and elytral disks, with cinereous hairs distributed as follows: Sparse laterally and narrowly across the base of the pronotal disk; each elytron with a sutural vitta, narrowly on the basal margin, on the declivous sides and apical declivity, dense on the scutellum. Lateral pronotal fimbriae ashy, moderately long and regular, increasing slightly in length from apex to basal fourth, and there reversed in direction. Elytral marginal fringe shorter, hairs quite equal in length and less closely spaced to apex. Pubescence of the ventral surface short, fine, dense and closely appressed to the surface, dark in color.

Head moderately small, widest across the eyes and there about a third wider than long before the post-ocular line. Frons very feebly convex, surface finely and densely punctato-scabrous, a slight glabrous tumescence present on the median line at the epistomal base; articulating membrane and labrum blackish to paler. Eyes large, prominent, not setose, facets very small. Antennae moderate in stoutness, equal in length to that of the pronotum; blackish throughout, basal segment sometimes paler, distal segments slightly wider and stouter, a little more prominent anteriorly than posteriorly (viewed in lateral extension); third segment obconical and less than a third longer than wide at apex; segments fourth, fifth and sixth subtriangular, the fifth largest and most prominent anteriorly; seventh less triangular and more rounded anteriorly; segments eighth, ninth and tenth gradually broader and rounded, prominent anteriorly, tenth widest; eleventh subovate, about a third longer than wide.

Pronotum suboval, about one-fifth wider than long; apex transverse to feebly sinuate, equal in width to that of the head across the eyes, angles bluntly rounded and not in the least prominent; sides broadly arcuate and continuously so with the much less arcuate base. Disk somewhat strongly

convex, rather more arcuately declivous antero-laterally than usual in about apical third; surface rather closely punctate, punctures well defined, separated by a distance equal to one or two times their diameter, intervals extremely finely granulate.

Elytra oblong-oval, a little less than twice as long as wide; base transverse, a little wider than that of the pronotum, humeri not prominent and evenly rounded, scutellum quadrate; sides parallel, scarcely arcuate, parabolically rounded at apex, the latter slightly emarginate at the suture, angles narrowly rounded. Disk moderately and evenly convex, arcuately and very gradually declivous laterally, most so apically, abruptly so and somewhat impressed at and beneath the humeri, very feebly subexplanate in the submarginal area; marginal bead fine, feebly reflexed and very slightly denticulate, frimbriae pale; surface somewhat finely and densely punctate, slightly impressed within the small humeral umbones.

Abdomen extremely finely punctate. Legs moderate in length and stoutness; metafemora straight and not adapted to sides of body; metatarsi five-sixths as long as their tibia.

Male: Usually somewhat narrower. Abdomen less convex, fifth segment truncate and feebly sinuate at apex, surface not modified.

Female: Usually broader. Abdomen moderately convex, fifth ventral segment longer and arcuate at apex.

Measurements: (Types) Length 4 mm.; width 1.5 to 1.9 mm.

Holotype.—Female; Clark County, Nevada; (C. C. Searles); [Author's collection, California Academy of Sciences, no. 5214].

Allotype.—Male; with same data; [Author's Colln.; no. 5215].

Paratypes.—22; with same data.

Paratypes.—22 specimens of both sexes; with same data as for types. Distribution: Author's Colln., Colln. Natural History Museum, Balboa Park, San Diego, and Colln. The American Entomological Society.

Fifteen additional specimens were studied.

In a series of more than a hundred specimens submitted to the author for study, over two-thirds of them had been entirely denuded of pubescence by psocids (*Troctes divinatorius* Muller), which have been observed in action as follows: On one occasion, while examining a specimen of the series under the microscope, one of the pests suddenly appeared from the ventral surface onto that of the elytra; it moved about between the hairs, finally biting off one close to its base, retaining it between the mandibles. At another time when studying the pronotal characters of a specimen under a binocular, one of the lateral fimbriae was observed waving

in a very unusual and irregular manner; suddenly a psocid appeared from beneath the pronotal margin, it was nibbling the base of a fimbria which it held between the mandibles. The psocid was feeding. These observations explain one of the causes of denudation, when the pubescence has not been rendered distasteful by reagents.

Triorophus lariversi new species

The species is to be recognized by the smooth and polished surface, slender antennae, with the ninth and tenth segments triangular, and as long as wide. The frons is broadly and feebly impressed behind the epistomal umbo, punctures are absent or very minute, becoming slightly larger and sparse toward the vertex; two long and parallel plicae are present each side within the supra-orbital carina, the intervening surface quadrately defined between the epistomal umbo anteriorly and the summit of the vertex, short parallel rugulae may be present, very feeble or absent.

Pronotal sides are convergent behind the middle and not sinuate before the basal angles. The elytral striae of punctures become obliterated at apical third; punctures moderately small and well defined; humeral angles small, sharp, distinct and exposed.

In *gracilicornis* and *longicornis* of Casey the tenth antennal segments are longer than wide, the frons more strongly punctate in these and other species. *Lariversi* is only known from Nevada; it is neither Opaque nor pubescent, although the elytral punctures possess extremely minute pale setae, visible only under high power. The species is described as follows:

Form elongate subovate, about two and one-half times as long as wide. Surface smooth and shining. Color castaneous, palpi rufous, antennae rufo-castaneous.

Head relatively moderate in size, when fully retracted the eyes are in contact with the inner surface of the pronotal angles; eyes and sides of the front equally prominent; side margins evenly arcuate over the antennal insertions, subparallel in basal half, thence converging to apex of the mandibular notch, the latter well marked, partly encircling the superior mandibular base; sides of the adjacent epistoma arcuately emarginate, then angulate, thence straight and convergent to the apical angle. Frons feebly convex between the eyes, becoming somewhat broadly, rather widely and transversely impressed at and around the base of the evenly and strongly convex umbo; sides evenly convex over the antennal insertions from the eyes to the man-

dibular notch and, limited internally by the continuation of the supra-orbital carinae which extend forward to the summit of the convex sides; laterally the surface of the frons within the carinae is marked by two, sometimes three plicae that extend forward from sides of vertex just behind the eyes to the forward limit of the supra-orbital carinae, these plicae are straight and parallel, separated by rather narrow sulci; surface behind the eyes and lateral to the frontal folds is marked by two or three small rather oblique rugae which become obsolete on the tempora. Surface discretely punctate, punctures fine to obsolete on the impressed area, well defined on the umbo and apical portion of the epistoma, larger on the convex sides. Mandibles strongly and closely punctate. Terminal segment of the palpi subsecuriform. Antennae slender, in length extending two or three segments beyond the pronotal base; segments two to seven obconico-cylindrical, second two-thirds as long as the third, the latter three times as long as wide at apex; ninth and tenth triangular and as long as wide; eleventh smaller and oval.

Pronotum about one-sixth wider than long; apex one-sixth wider than the base, feebly and broadly arcuate, becoming slightly sinuate within the small and acute angles; sides broadly arcuate anteriorly, less so posteriorly and converging to base, marginal bead not coarse; base broadly, very moderately arcuate, marginal bead broad and flat, angles distinct and obtusangular. Disk strongly convex, punctures rather coarse and evenly distributed, separated by a distance equal to two or three times their diameter, slightly coarser laterally, discrete throughout.

Elytra oval, about two and two-thirds times as long as the pronotum and one-third longer than wide; base broadly emarginate and narrowly margined, slightly wider than the pronotal base, humeral angles distinct and slightly acute; sides rather strongly and broadly arcuate to the obtuse apex; surface strongly convex from side to side, margins not visible from above, bead fine and sharp, strongly and acuately declivous apically, subapical surface impressed; striate, striae of discrete and rather coarse punctures, separated by a distance equal to two or three times their diameter, becoming gradually smaller and obsolete on the apical declivity; intervals with widely distributed punctules. Scutellum small, not entering between the elytra beyond the basal bead. Epipleurae narrow and impunctate.

Sterna and parasterna very coarsely punctate. First abdominal segment similarly punctate laterally, centrally more or less punctulate about the pubescent fovea of the male. The fovea not impressed, rather small and oval, hairs short, dense and yellowish or brown in color; the other segments very sparsely punctate. Legs slender and moderate in length.

Measurements.—(Types) Length 8–9.5 mm.; width 3 to 4 mm.

Holotype.—Male; Lovelock, Nevada; June 15, 1941; (Ira La Rivers); [Author's collection, California Academy of Sciences, no. 5282].

Allotype.—Female; with same data; [Author's Colln., Cal. Acad. Sci., no. 5283].

Paratypes.—1 ♂, 1 ♀; with same data as for type. 4 ♂, 4 ♀; Pyramid Lake, Nevada, August 31, 1914. 2 ♂, 1 ♀; Alamo, Nevada, January 17, 1941. Distribution: Author's Colln., Colln. Ira La Rivers, and The American Entomological Society.

Three additional specimens were studied.

Eleodes striatipennis new species

This species is described as new from a series of 31 specimens. Ira La Rivers the collector states that it occurs abundantly in the sand dune areas at Walker Lake and Paradise Valley, Nevada. The specimens show difference in size, that varies from 17 to 25 mm. in length; the body surface is dull without sericeous luster, the elytra distinctly striate, the striae are not noticeably impressed and, composed of small, distinct and closely placed punctures; in the males the elytra are elongate and subparallel, the sides broadly arcuate. The smaller specimens are somewhat ovate in form and, the striae show a tendency to become less distinct, these can be compared with the homologous subspecies *pumila* Blaisdell of *armata* LeConte of more southern habitat. In *Eleodes amedeensis* Blaisdell the surface luster is distinctly sericeous and, the elytral striae less distinct. *Armata* is larger and more variable in form, with the femoral spurs much stronger. Long series of most species of *Eleodes* show marked extremes in size and sculpturing. The species is described as follows:

Form moderately large, elongate suboval to subfusiform-ovate, two and two-thirds times as long as wide. Color dull black. Elytra striate.

Head relatively moderate in size, widest across the eyes, a little less than twice as wide as long before the post-ocular line; side margins over the antennal insertions arcuate, converging slightly to the oblique suture, thence the sides of epistoma are convergent and feebly arcuate to the obtuse apical angles, apex transverse. Frons slightly convex, oblique sutures distinct, the transverse more or less obliterated at middle; surface discretely and rather irregularly punctate, punctures moderately small, slightly smaller and denser laterally, each with a very short, black seta; vertex more densely and finely punctate; tempora feebly convex and convergent posteriorly from margin of the eyes, densely punctate and setose. Labrum arcuate laterally and continuously so with the apex, the latter emarginate at middle; surface densely punctate apically, each puncture with a rather long seta, those of the margin brownish.

Antennae moderate in length, about attaining the pronotal base, second segment short, about as long as wide at apex and subannular; segments three to six inclusive cylindrico-subconical; third about five times as long as wide at apex and twice as long as the fourth, the latter twice as long as wide at apex; segments five to eight quite equal in length; fifth and sixth about one-half longer than wide at apex; seventh feebly triangulo-obconical, eighth subtriangular; the latter to the eleventh slightly wider than the preceding; ninth and tenth somewhat irregularly spherical, as long as wide; eleventh obovate, truncate at apex and as long as wide.

Pronotum about one-seventh wider than long, widest at middle; apex broadly and deeply emarginate, finely beaded within the angles, the latter distinctly prominent anteriorly and acute; sides moderately arcuate, less so and somewhat straighter behind the middle, slightly sinuate behind the apical angles, marginal bead fine; base equal in width to the apex, broadly, evenly but not strongly arcuate to the angles, marginal bead narrow, angles small and obtuse. Disk evenly and moderately convex, finely and somewhat sparsely punctulate, punctules well defined laterally, subobsolete centrally.

Elytra one and four-fifths times as long as wide, but variable, widest slightly behind the middle; about two and three-fourths times as long as the pronotum; base scarcely wider than pronotal base, not margined, broadly and feebly emarginate, humeral angles distinct but not in the least prominent; sides broadly and moderately arcuate, apex obtuse. Disk moderately convex centrally to slightly deplanate, broadly and arcuately declivous and inflexed laterally; arcuately and obliquely declivous in about apical fourth; distinctly striate, slightly less so on the lateral and apical declivities, punctures small, well defined and separated by a distance one or two times their diameter; intervals with a series of similar and widely spaced punctures. Epipleurae narrow, gradually widening before the middle, becoming very narrow to apex.

Ventral surface very irregularly and indistinctly punctate. Intercoxal prosternal process mucronate at apex. Prothroracic sides rather strongly convex. Abdomen variable according to sex. Legs long and rather strongly sculptured; femoral teeth rather narrow, comparatively long and acute. Tarsi not noticeably elongate and rather robust.

Male. Narrower and more subfusiform-ovate. Abdomen less convex, flattened in middle third on segments one, two and three, and more or less impressed on the median line; surface finely and quite sparsely punctulate.

Female. Moderately broader and more elongate subovate. Abdomen rather strongly convex; surface finely and sparsely punctulate.

Measurements.—(Types) Length 24–28 mm.; width, 8–10 mm.

Holotype.—Male; Winnemucca, Nevada; July 4, 1941; (Ira La Rivers); [Author's collection, California Academy of Sciences, no. 5286].

Allotype.—Female; with same data; [Author's Colln. Cal. Acad. Sci., no. 5287].

Paratypes.—2 ♂, 2 ♀; Walker Lake, Nevada. 2 ♂, 2 ♀; Paradise Valley, Nevada. 1 ♂, 2 ♀; Tonopah, Nevada, July 26, 1941, (J. R. Slivin). Distribution: Author's Colln., Colln. Ira La Rivers, and The American Entomological Society.

Sixteen additional specimens were studied.

Blapstinus vandykei new species

Vandykei can be recognized by the moderately small size, somewhat more abundant brownish pubescence and well developed wings. Its genetic relationship is apparently with that of *castaneus* and *histricus* Casey and *coronadensis* and *amnosus* Blaisdell. Compared with *castaneus,* the body color is quite the same; the latter is as a rule a little larger and less convex, pubescence paler in color, less abundant and the striae less defined; in perfect specimens of *vandykei* the pubescence is confined to the intervals, rendering the striae more evident. In older and worn specimens the pubescence is usually more or less displaced or lost and the striate appearance effaced. Col. Casey in discussing *castaneus* mentions two variations in particular, stating that he was convinced that the variations represent several distinct species. *Vandykei* is evidently one of these, as the author has been able to associate specimens referred to *castaneus* from Palm Springs, California, and from Phoenix, Arizona.[2]

Form moderately small, oblong-oval, about two and a third times as long as wide and moderately convex. Color nigro-piceous, frontal margin and labrum more or less and legs rufous. Pubescence moderately dense, loosely decumbent and in perfect specimens confined to the intervals, brownish, slender, moderately short and somewhat conspicuous.

Head relatively small, widest just before the eyes and about twice as wide as long before the post-ocular line, marginal outline nearly evenly arcuate from side to side, including the tempora; epistoma slightly and arcuately emarginate over the labrum. Frons moderately convex, epistomal sutures obliterated; surface slightly impressed before the eyes, rather coarsely and densely punctate, punctures not confluent but in close contact, slightly smaller on epistoma and sides. Eyes relatively large, superior and inferior lobes slightly oval and similar. Labral apex narrowly deflexed and scarcely emarginate. Antennae slender, about attaining the pronotal base, in length quite equal to width of pronotal base; first segment slightly stouter than the second, the latter to the sixth obconical, second and fourth equal in length, third

[2] The type locality for *castaneus* is El Paso, Texas; for *histricus,* Newhall, Ventura County, California; *coronadensis* near San Diego, Southern California; for *amnosus,* Lower California.

elongate, twice as long as second; sixth and seventh segments obconico-oval, equal in length and width; segments eighth, ninth and tenth increasing slightly in width, equal in length, more circular in outilne and feebly compressed; eleventh oval and a little longer than wide.

Pronotum about two-fifths wider than long, length at middle equal to width of head; apex slightly emarginate, angles rather narrowly rounded and not in the least prominent; sides subparallel, slightly arcuate, feebly convergent before the middle; base broadly arcuate in middle two-fourths, feebly sinuate laterally, angles obtusely rounded; margins finely beaded. Disk less than moderately convex from side to side and without basal impressions, densely and evenly punctate, punctures in close contact centrally, slightly confluent laterally.

Elytra twice as long as wide, a little less than three times as long as the pronotum, and about one-fourth wider at middle than the latter, at base slightly wider than the pronotal base, humeri rounded and not in the least prominent; sides subparallel, broadly and moderately arcuate, quite parabolically rounded in apical one-fourth, slightly emarginate at the suture, angles rounded. Disk less than moderately convex, quite evenly and arcuately declivous laterally, more gradually so in apical fourth; striae distinct, punctures small, separated by a distance equal to one or two times their diameter, intervals not convex, finely and irregularly punctate; normally the pubescence is confined to the intervals, rendering the striae more exposed producing a lineate appearance. Surface very finely, densely subasperate.

Legs moderate in length and stoutness. Metafemora straight and about equal in length to the metatibia; metatarsi about one-ninth shorter than their tibia, basal segment equal in length to the second and third taken together.

Male. Slightly more parallel and narrower. Profemora moderately swollen. Protarsi moderately dilated, second and third segments subequal in width and length, the width about equal to the fourth antennal segment; first segment subtriangular, relatively stout and a little narrower than the second, fourth one-half as wide as third, triangular; first three segments densely pubescent beneath. Mesotarsi feebly dilated. Abdomen less than moderately convex, first three segments feebly impressed in middle third.

Female. Slightly wider, subparallel and feebly ovate. Abdomen moderately convex.

Measurements.—(Types) Length 5 to 5.5 mm.; width 2 to 2.5 mm.

Holotype.—Female; Death Valley, Inyo County, California; March 13, 1941; (Edwin C. Van Dyke); [Van Dyke Collection, California Academy of Sciences, no. 5288].

Allotype.—Male; with same data; [Colln. Van Dyke, Cal. Acad. Sci., no. 5289].

Paratypes.—15 specimens; with same data; [Colln. Van Dyke, Cal. Acad. Sci., 9; Colln. American Entomological Society, 6].

II. A Brief Review of the Species of Eleodes Subgenus Litheleodes, with the Description of a New Subspecies (Tenebrionidae)

The recent collecting of more abundant specimens of the different species and subspecies belonging to the subgenus *Litheleodes,* calls for a review of the taxonomic relationships. It is the desire of the author, to aid the student in the determination of the species, by presenting the specific characteristics of the several, distinct forms. If greater details are needed, the student should consult the author's Monograph of the Eleodiini.[3] The species are divisible into three distinct groups as follows:

Arcuata Group. Those species having a smooth surface, a simple sculpturing not in the least asperate; the anterior femora distinctly mutic in both sexes.

Extricata Group. All those species having the anterior femora distinctly dentate in the male. Elytra more or less densely punctate, punctures not distinctly muricate, series more or less evident, intervals rather narrow; punctation at times more or less confused and varying in coarseness.

Granulata Group. The species have the anterior femora mutic or simply angulate (subdentate). Elytra more strongly sculptured and more or less granulate, muricato-tuberculate or simply tuberculate.

The species may be briefly characterized as follows:

Arcuata Group

Eleodes (Litheleodes) arcuata Casey

Litheleodes arcuata Casey, Contr. to Descr. and Syst. Col. of N. A., pt. 1, p. 47, 1884. Annals N. Y. Acad. Sci., v, p. 395, Nov. 1890.

Form oblong-ovate to ovate, robust. Surface glabrous, more or less shining, color intense black. Finely sculptured, elytral punctures small, simple and subserial. Anterior femora more or less feebly angulate in both sexes.

Type locality.—Arizona.

Distribution.—Occurs in the Santa Rita and Chiricahua Mountains.

[3] Blaisdell, F. E., The Eleodiini, *U. S. Nat. Mus.,* Bull. 63, p. 114–138, 1909.

Extricata Group

Eleodes (Litheleodes) extricata (Say)

Blaps extricata Say, Jour. Acad. Nat. Sci. Phila., III, p. 261, 1823.
Eleodes extricata LeConte, Proc. Acad. Nat. Sci. Phila., p. 181, 1858. Horn, Trans. Amer. Phil. Soc., XIV, p. 309, 1870. Casey, Contr. to Descr. and Syst. Col. of N. Amer., pt. 1, p. 48, 1884.

Size moderate, 10 mm. more or less in length. Form fusiform-ovate to ovate in the sexes, surface shining. Pronotum sparsely punctulate; apical angles obtuse not acute, basal angles rounded, not evident. Elytra densely and more or less irregularly punctate, punctures rather coarse, not distinctly muricate or feebly so, series somewhat binary at times and the alternate intervals slightly wider, as seen viewed longitudinally.

Habitat.—Widely dispersed from Arizona, Texas and Colorado to Canada.

Eleodes (Litheleodes) extricata subspecies **convexicollis** Blaisdell

Eleodes extricata forma convexicollis Blaisdell, U. S. Nat. Mus. Bull., no. 63, p. 123, 1909.
Eleodes (*Litheleodes*) *extricata* var. *convexicollis* Blaisdell, Can. Entom., LIII, p. 132, 1921.

Similar in form and sculpturing to *extricata* Say, size smaller; pronotum strongly, transversely convex.

Habitat.—Wyoming: Lamarie; Montana.

Eleodes (Litheleodes) extricata subspecies **arizonensis** Blaisdell

Eleodes (*Litheleodes*) *extricata* var. *Arizonensis* Blais., Can. Ent., LIII, No. 6, June, 1921, p. 132.

Similar in form to typical *extricata* Say, but with the elytra more or less costate on the alternate intervals, the intervening intervals wide, two series of distinct punctures separated by similar irregular punctures.

Habitat.—Arizona.

Eleodes (Litheleodes) extricata subspecies **utahensis** Blaisdell

Eleodes (*Litheleodes*) *extricata* var. *utahensis* Blaisdell, Can. Ent., LIII, No. 6, p. 131, June, 1921.

Rather less robust, somewhat elongate. Surface not strongly sculptured, pronotum quite impunctate or not; elytral punctures finer and less distinct. Luster dull.

Habitat.—Utah: Stockton, Milford and Eureka.

Eleodes (Litheleodes) extricata subspecies **cognata** Haldeman

Eleodes cognata Haldeman, Stansbury's Explor. and Survey, Great Salt Lake, Utah, Appendix C, p. 376, 1852. Casey, Annals N. Y. Acad. Sci., v, p. 395, Nov., 1890.

Size somewhat larger, surface luster more or less dull. Punctation denser and rather coarse, that of the elytra irregular (viewed from above), but in close series as seen when viewed obliquely from behind. Two forms recognizable: One in which the punctation is less dense and not as distinctly defined; in the other distinctly denser and well defined.

Habitat.—Arizona: Pinal Mountains; Colorado: Gulnare; Utah; New Mexico: Cloudcroft, 9000 ft.

Granulata Group

Eleodes (Litheleodes) granulata LeConte

Eleodes granulata LeConte, Reports of Explor. and Surveys . . . 47th and 49th Parallel, XII, Appendix, No. 1, p. 50, 1857, (female). Horn, Trans. Amer. Phil. Soc., XIV, p. 309, 1870. Blaisdell, Mon., Bull. 63, U. S. Nat. Mus., p. 127, 1909.

Form ovate, male narrower; size moderate, length near 10 mm. Head densely punctate. Pronotum subquadrate, moderately densely punctate; sides arcuate, basal angles obtusely rounded. Elytra rather densely, irregularly submuricato-granulate, most marked laterally and apically. In fact the granulate condition is really due to small, flat or convex tubercles and scattered intervening muricate punctures.

Habitat.—Oregon; northern California: Siskiyou County.

Eleodes (Litheleodes) granulata subspecies **obtusa** LeConte

Eleodes obtusa LeConte, Proc. Acad. Nat. Sci. Phila., p. 352, male, 1861.
Litheleodes obtusa LeConte.—Blaisdell, Mon., Bull. 63, U. S. Nat. Mus., p. 130, 1909.

Form elongate, as in *granulata*, length near 13 mm., luster dull. Head and pronotum densely punctate, sides of the latter arcuate, less so posteriorly and rather oblique, basal angles obtuse, disk with small irregular smooth areas each side of middle. Elytra sculptured with flattened elevations laterally and apically; the oval elevations are smaller in the parasutural area and not distinctly seriate. The elevations are obsoletely muricate and not shining.

Habitat.—Eastern California (Desert region).

Eleodes (Litheleodes) granulata subspecies **aspera** LeConte

Eleodes aspera LeConte, Smithson. Miscel. Coll., No. 167, p. 115, 1865.
(?) *Eleodes subaspera* Solier, Studi Entomol., II, p. 246, 1848. Blaisdell, Mon., Bull. 63, U. S. Nat. Mus., p. 130, 1909.

Form resembles *granulata,* opaque, head and pronotum rather strongly and densely punctate. Pronotal apex subemarginate, angles not prominent; sides finely margined, arcuate, subsinuate behind the apical and before the basal angles; disk moderately convex. Elytra oval to slightly ovate, humeri subacute; apically strongly declivous and gradually narrowed, dorsal area somewhat flattened; surface sculptured with shining, reclinate, feebly piliferous granules densely and subseriately placed.

Habitat.—Colorado: Gateway, June 29, 1932, 1 specimen.

Eleodes (Litheleodes) vandykei Blaisdell

Eleodes letcherl var. *vandykei* Blaisdell, Mon., Bull. 63, U. S. Nat. Mus., p. 136, 1909.

Recent studies indicate that *vandykei* is not a race of *letcheri.*

Form moderately ovate, narrower in the male, length 10 to 13 mm. Surface luster dull. Pronotum quadrate, sides less arcuate in the male than in the female; apex sinuate, angles obtuse not prominent. Elytra not pubescent, densely sculptured with small raised areas, subseriate as viewed obliquely from behind; each puncture with a short, inconspicuous and semi-recumbent seta.

Habitat.—California: Modoc County.

Eleodes (Litheleodes) vandykei subspecies **modificata** Blaisdell

Eleodes (*Litheleodes*) *vandykei* variety *modificata* Blaisdell, Can. Ent., LIII, pp. 131–132, June, 1921.

Form and size similar to that of *vandykei.* Deep black and shining. Pronotal apex transverse, angles not in the least prominent; sides arcuate, slightly sinuate before the basal obtuse angles. Elytra moderately coarsely submuricato-rugose throughout with scattered punctures in the intervals, the parasutural area is more punctato-rugose.

Habitat.—British Columbia: Vernon.

Eleodes (Litheleodes) vandykei subspecies **parvula** Blaisdell

Eleodes letcheri var. *vandykei* forma *parvula* Blaisdell, Mon., Bull. 63, U. S. Nat. Mus., p. 137, 1909.

Eleodes (*Litheleodes*) *vandykei* var. *parvula* Blaisdell, Can. Ent., LIII, p. 132, June, 1921. (Synopsis.)

Size smaller, length 10 to 13 mm.; width 4.5 to 7 mm.

Form ovate. Pronotum relatively small, quadrate; apex truncate, angles small, acute, not prominent; sides less arcuate in the males than in the females; base feebly arcuate, angles small and obtuse. Elytra distinctly asperate with muricate granules, longitudinal series somewhat evident, parasutural area less strongly sculptured.

Habitat.—Oregon: Dalles; Idaho: Blackfoot.

Eleodes (Litheleodes) vandykei similis new subspecies

Form moderately small, subfusiform-ovate to ovate. Color black, luster alutaceous to somewhat shining; ventral surface more shining and polished.

Head relatively moderate in size, not quite twice as wide as long before the post-ocular line, widest just before the eyes. Side margins moderately arcuate over the antennal insertions, thence convergent and nearly straight to the epistomal angles, the latter obtusely rounded; epistomal apex transverse. Frontal surface slightly convex, feebly and broadly impressed within the slightly convex sides, the latter feebly declivous against the eyes; sutures obliterated, densely and discretely punctate laterally and anteriorly, punctures contiguous and well defined, relatively small and not visibly setose; less dense centrally and toward vertex, separated by a distance equal to one to three times their diameter. Labrum slightly convex, lateral margins evenly arcuate, continuously so with the apex, the latter briefly and arcuately emarginate at middle; densely punctate, punctures setigerous, the setae longer on margin and paler in color. Tempora feebly convex, converging from the eyes to the nuchal constriction, punctures distinctly setigerous, setae black.

Antennae moderately long, slender, extending about two segments beyond the pronotal base. First segment moderately stout, second small, subannular and feebly obconical, as long as wide, one-third as long as the third segment, the latter, fourth and fifth obconico-cylindrical, third three times as long as wide at apex; fourth a little longer than fifth, the latter subequal to sixth, which is a little shorter and slightly wider at apex; seventh slightly triangular and about as wide at apex as long; seventh, eighth and tenth moderately compressed, feebly wider than preceding segments, the seventh more triangular, eighth and tenth irregularly suboval; eleventh longer than wide near base, ovate, truncate at apex and flattened apically.

Pronotum about one-seventh wider than long; apex slightly emarginate, obsoletely beaded; sides arcuate in anterior two-thirds, continuously so with the well rounded apical angles, straighter and convergent posteriorly to the obtusangular basal angles, marginal bead narrow; base about one-sixth wider than apex, broadly arcuate. Disk rather strongly convex from side to side, moderately evenly punctuate, punctures discrete, rather evenly defined, moderately shallow, separated by a distance equal to one or three times their diameter, somewhat denser laterally, submarginal area linearly impressed against the bead.

Elytra widest at middle, about two and one-half times as long as the pronotum; base broadly and rather slightly emarginate, not beaded, slightly wider than pronotal base; scutellum transverse, apex arcuate; humeral angles slightly acute, feebly prominent anteriorly; sides broadly and moderately strongly arcuate to apex, marginal bead rather thin. Disk moderately convex, becoming more strongly so laterally and arcuately declivous; apical declivity moderately abrupt, arcuately oblique; irregularly punctate in the central area, punctures slightly impressed and moderate in size; sides and apical declivity becoming gradually scabrous, the punctures muricate, slightly tuberculate and reclinate. Sterna and parasterna more or less finely and muricately punctate.

Abdomen rather densely punctate, punctures small and the surface more or less rugulose. Legs slender and moderate in length. Metafemora slightly longer than the metatibiae. Metatarsi a little less than two-thirds as long as their tibia; first segment twice as long as the second or third segment, the latter subequal, fourth a little shorter than the first.

Male. Narrower subfusiform-ovate, relative size about two and one-third times as long as wide. Elytra about one and one-half times as long as wide, nearly one-fourth wider than pronotum but variable. Abdomen moderately convex, slightly impressed in middle third.

Female. Ovate, about twice as long as wide. Elytra about one-fourth wider than the pronotum, slightly inflated but variable. Abdomen strongly convex.

Measurements.—(Types) Length 12–12 mm.; width 4.5 to 5 mm.

Holotype.—Male; Haines, Oregon; April 20, 1941; (K. M. Fender); [Author's collection, California Academy of Sciences, no. 5284].

Allotype.—Female; with same data; [Author's collection, Cal. Acad. Sci., no. 5285].

Paratypes.—5 ♂, 3 ♀; with same data. Distribution: Author's collection, Cal. Acad. Sci., 3; Colln. American Entomological Society, 5.

Eleodes (Litheleodes) letcheri Blaisdell

Eleodes letcheri Blaisdell, Mon., Bull. 63, U. S. Nat. Mus., pp. 133–136, 1909. (Sypnopsis.) Can. Ent., LIII, No. 6, p. 132, June, 1921.

Form and sculpturing as in *vandykei*. Surface luster opaque. Elytra with moderately long fine hairs. In the males the anterior margins of the under surface of the anterior tibiae are subangulate.

Habitat.—Nevada, toward Truckee from near Verdi. Idaho.

Eleodes (Litheleodes) corvina Blaisdell

Eleodes corvina Blaisdell, Stanford Univ. Publ., I, (No. 3), pp. 224–225, 1921.
Eleodes (*Litheleodes*) *granulata* var. *corvina* Blaisdell, Can. Ent., LIII, p. 132, June, 1921. (Synopsis.)

Male elongate subovate, female ovate. Deep black, shining, head and pronotum duller in luster. Pronotum similar in the sexes, apex truncate, angles narrowly rounded; sides strongly arcuate; basal angles obtusangular; disk densely punctate, punctures moderate in size, small impunctate areas present. Elytral sculpturing strong, coarsely punctato-rugose in the parasutural area, rugoso-tuberculate laterally and apically, tubercles flat, very irregular, setae minute.

Habitat.—California: Walker, Siskiyou Co., (C. L. Fox); Dry Lake, Klammath National Forest; [Collection of E. C. Van Dyke].

Eleodes (Litheleodes) papillosa Blaisdell

Eleodes granulata forma *tuberculata* Blaisdell, Mon., Bull. 63, U. S. Nat. Mus., p. 131, 1909.

Eleodes papillosa Blaisdell, Ent. News, XXVIII, pp. 226–227, May, 1917. (Syn. *granulata* forma *tuberculata.*)

Larger and more robust than *granulata* LeConte, deep black in color and feebly shining. Head densely punctate, sides and eyes equally prominent. Pronotum widest before the middle, sides arcuate before the middle, thence straighter and converging to base; pronotal punctation dense, like that of *Upis ceremboides,* but distinctly not coalescent, discrete, moderately coarse and somewhat shallow. Elytra densely sculptured with conical more or less reclining tubercles with scattered minute points between, almost like those of *Pseudeleodes granosa* LeConte. Abdomen of the male moderately convex, segments not impressed along the median line of the first three segments.

Measurements.—Male.—Length 16 mm.; width 6 mm. Female.—Length 15 mm.; width 13.5 mm.

Habitat.—California: Siskiyou Co., [Collections of the National Museum and that of Albert Koebele].

III. A Study of the Differential Characters of the Species belonging to the Genus Aphanotus. (Tenebrionidae)

Aphanotus LeConte

1866. LeConte, Class. Coleopt. N. Amer., p. 233. 1870. Horn, Trans. Amer. Philo. Soc., XIV, p. 368. (Revis. Tenebr.) 1883. LeConte and Horn, Smiths. Misc. Coll., no. 507, p. 381. (Class. Coleopt. Amer. N. of Mex.)

Form elongate, parallel, epipleurae entire. Head relatively moderate in size, not tuberculate; epistoma truncate to feebly sinuate at apex, surface convex, slightly concave laterally, sutures indistinct; mentum relatively moderate in size, last segment of the maxillary palpi oblong-subfusiform, slightly compressed, scarcely triangular. Eyes very deeply emarginate to complete division or not, by the backward extension of the sides of the front, superior ocular lobes oblique.

Antennae moderately short, rather stout, gradually broader to tip; first and second segments thicker than the third; second short, nearly globular; third slightly longer than the fourth; segments four to eleven very gradually wider, the eleventh subquadrangular, larger and quite truncate at apex.

Base of prothorax applied against the bases of the elytra, or somewhat distant from them. Elytra elongate, about twice as long as wide, sculptured with striae of faintly impressed punctures, intervals flat except at middle where they form an elevated carinated line. Pronotal intercoxal process arcuate between the coxae, not in the least prominent. Mesosternum very slightly concave. Anterior tibiae more or less dilated, broader than the middle tibiae, not denticulate. Metatarsi short, first segment equal to the two intermediate, fourth longer than the first.

Three species are listed at the present time and may be recognized from the following characterizations:

Aphanotus brevicornis (LeConte)

Eulabis brevicornis LeConte, Proc. Acad. Nat. Sci's. Phila., XI, p. 78, 1859.
Aphanotus brevicornis Horn, Trans. Amer. Philo. Soc., XIV, p. 268, 1870. (Revis. Tenebr.)
Aphanotus brevicornis Casey, Annals N. Y. Acad. Sci's., V, p. 483, 1890. (Coleopt. Notices.)

Eyes completely and distinctly divided, facets moderate in size. Sides of head moderately explanate, margins quite evenly arcuate to very feebly sinuate; the lateral processes of the front distinctly attain the temporal angles opposite the posterior margins of the ocular lobes. Frontal punctures shallow, equal in size and discrete; intervals sometimes slightly and irregularly prominent. Superior ocular lobes oblique and a little below the surface plane, oblong-oval, twice as long as wide, truncate posteriorly and obtusely rounded anteriorly, supra-ciliary margin not elevated. Inferior lobes suboval, narrowed basally, forming a lateral angle at line of union of the lateral frontal processes and temporal angles. Last segment of the maxillary palpi subcylindrico-oval, about twice as long as wide, apical sensory area circular. Genial processes produced, about twice as long as wide. Antennae short, gradually dilated from the sixth segment, the segments in close contact, the eleventh wider than long and truncate at apex, the sensitive area may be slightly swollen and somewhat arcuate.

Pronotum about a fourth wider than long, apex truncate between the prominent angles; lateral marginal beads fine, not dilated on angle, continued onto the lateral thirds of the apex; discal surface moderately convex and not more arcuately declivous at the angles. Elytra elongate, sculptured with striae of slightly impressed punctures, intervals flat except at middle where each is moderately finely costate.

Measurements.—Length 5 to 6 mm.; width 2 to 2.5 mm.

Type locality.—Fort Tejon, Kern County, California.

Distribution.—All the specimens at hand or studied from elsewhere, are from the length and breadth of California.

Aphanotus parallelus Casey

Aphanotus parallelus Casey, Annals N. Y. Acad. Sci., v, p. 483, 1890. (Coleopt. Notices.)

Eyes not completely divided, the lateral frontal processes not attaining the temporal angles, the interval of separation equal to about the combined width of two facets, opposite to the posterior part of the ocular lobes. Sides of head scarcely less explanate than in *brevicornis* LeConte, but less prominent posteriorly, margins evenly arcuate. Frontal punctures dense, less discretely defined. Eyes larger, superior lobes oblique, oblong-subovate, truncate and wider posteriorly, obtusely rounded antero-internally, facets larger and easily observed in transverse series; inferior lobes relatively large, subcircular, slightly convex and as wide as long. Terminal segment of the maxillary palpi subfusiform, slightly compressed, a little more than twice as long as wide at middle, apical sensory area slightly oblique. Buccal processes of the genae short, as wide as long. Antennae less stout, segments three to five inclusive cylindrical; distal segments gradually dilated, seventh to the eleventh more loosely articulated and slightly perfoliate.

Pronotal punctures dense, more or less discrete, not strongly defined; apical angles moderately prominent anteriorly and obtuse, margin somewhat stronger internally than laterally and reflected onto the lateral thirds of the apical margin; discal surface gradually declivous antero-laterally at the angles.

Measurements.—Length 5 to 6 mm., width 2.0 to 2.5 mm.

Type locality.—Benson, Arizona, (G. W. Dunn).

Distribution.—Arizona: Cottonwood, Grand Canyon; St. Xavier Mts., Tucson and Redington. California: Palm Springs.

Aphanotus destructor (Uyttenboogaart)

1933. *Tribolium destructor* Uyttenboogaart, Tijdschr. Ent., LXXVI, p. XII.

The first specimens received by the author, were collected by Mr. James E. Cottle of Hayward, Alameda County, California. The species was discovered infesting sun flower seeds bought at a local store, to be used for parrot food. Numerous specimens were reared, the larvae thrived on alfalfa meal and rolled oats, without water.

Ten of the Hayward specimens were deposited in the collection of the National Museum for identification. It was determined as *Tribolium destructor* Uytten. Two topotypes from Erfurt, Germany, were presented to the California Academy of Sciences, by the National Museum, for which the California Academy of Sciences is very grateful, and expresses its thanks for the gift. The author is indebted to Dr. Edward A. Chapin and Dr. Richard E. Black-

welder, Assistant Curators of the Division of Insects, for the determination of the species.

According to the studies and interpretation of the generic characters by the author the species is not a *Tribolium,* but a member of the genus *Aphanotus* LeConte. In *Tribolium* the eyes are only moderately emarginate, not deeply so. As it is a pest, infesting stored seeds and cereals it is necessary that the species be recognized by students of Economic Entomology. The original description of Uyttenboogaart is not readily available, therefore the author considers it important that the species be redescribed as follows:

Eyes not completely divided. Distal segments of antennae not perfoliate, less transverse and closely articulated. Frontal punctures more irregular, rather more distinctly defined and the intervals more evidently subrugulose in the central area. Lobes of the eyes smaller and sides of head more sinuate. Last segment of maxillary palpi cylindro-subfusiform, apical sensory area round. Pronotal apical angles broader, more rounded at apex, marginal bead dilated on their inner margin, but not reflected to the apical margin; discal surface at the angles rather more strongly and arcuately declivous.

Form parallel, elongate oval, three times as long as wide. Color nigropiceous to paler from immaturity; sides of head opposite to the eyes and before the antennal insertions within the frontal angles more or less rufous; surface slightly shining. Buccal angles of the genae short.

Head moderate in size, widest across the anterior margin of the eyes, twice as wide as long before the post-ocular line, width equal to length of pronotum at middle; sides moderately convergent apically, distinctly arcuate opposite to the eyes, thence rather broadly and feebly sinuate over the antennal insertions, becoming arcuately continuous with the epistomal angles, apex of epistoma slightly sinuato-truncate.

Frons rather moderately convex between the eyes, epistoma a little more strongly so and feebly declivous anteriorly to the apical margin; sutures slightly evident, surface at position of transverse suture feebly impressed; sides lateral to epistoma quite plane, becoming slightly convex over antennal insertions, and somewhat impresso-declivous against the eyes; vertex on same plane as frons, moderately and evenly, transversely convex; supra-orbital margins narrowly thickened and slightly elevated; surface densely punctate, punctures moderate in size, intervals at middle slightly longitudinally rugulose, separating punctures in twos and threes, the latter becoming smaller and less strongly defined laterally.

Eyes not in the least prominent, slightly sunken below the frontal plane, most so anteriorly; narrowly divided into superior and inferior lobes by sides of front and small temporal angles, the interval of separation equal to

one or two facets; superior lobe oblique, equal in width to about four facets, twice as wide as long and arcuate antero-internally; inferior lobes larger, rounded and moderately convex, about seven facets wide, the latter moderate in size, convex and not setose. Tempora small, feebly convex and convergent posteriorly.

Antennae rather stout, attaining middle of pronotum; first segment not visible from above, second to the sixth inclusive subcylindrical and nearly as long as wide, thence segments seven to ten gradually wider and transverse, eleventh circular in outline and as long as wide.

Pronotum moderately transverse, less than one-third wider than long, about two-fifths wider than head; base a third wider than apex, the latter not margined and somewhat feebly arcuate between the rather large and moderately, anteriorly prominent angles which are well rounded at apex; sides broadly and moderately arcuate, most so and convergent in apical third, sometimes very feebly and briefly subsinuate before the subrectangular basal angles, margin narrow, rather thin and slightly reflexed, widening on the inner margin of the apical angles; base broadly arcuate in central two-fourths, thence broadly sinuate to the angles, margin strongly beaded. Disk moderately and nearly evenly convex, more declivous at the apical angles, where the marginal bead is widened; densely punctate, punctures moderately coarse, discrete centrally, coarser and slightly more impressed laterally, the intervals forming rugulae with the punctures in slightly arcuate rows, lateral submarginal area more finely punctate.

Elytra twice as long as wide, three times as long as pronotum, somewhat depressed, slightly wider at middle than the pronotum; base broadly sinuate in middle two-fourths, not margined, scarcely wider than pronotal base; scutellum small, arcuate at apex, surface punctate; humeri small, not in the least prominent, narrowly rounded; sides parallel and feebly arcuate, subparabolically rounded in apical third, slightly emarginate at suture, each angle rounded. Disk less than moderately convex in each para-sutural third, thence more arcuately and declivous laterally; very gradually and arcuately declivous to apex in about apical third. Surface irregularly and rather densely punctate, punctures small, rather well defined; strial punctures not impressed; intervals costate, except the first two or three, costae abruptly elevated, very thin and subacute, gradually becoming somewhat more distinctly so laterally; summit of each costa appears to be between two rows of very minute punctules; in the feebly concave intervals the strial punctures form feeble, rather close-set series; scutellar area not costate, but irregularly punctate; marginal beads slightly reflexed, the submarginal area feebly impressed, particularly beneath the humeri where the margin is not visible from above.

Under surface of body smooth and shining, more strongly punctate, especially on the sterna, punctures discrete. Abdomen moderately convex, punctures separated by a distance equal to one or two times their diameter, denser on fifth segment. Punctures not setose except on the appendages. Femoral punctures small. Sexual differences in form not very noticeable, males more or less narrower than the females.

Measurements.—Length 6 mm.; width 2 mm.

Topotypes.—2; from Erfurt, Germany, FHB90623. Collected from the dried fruit of the Virginia Creeper.

Local specimens studied.—72; distributed as follows: Author's collection, California Academy of Sciences, 38; National Museum, Washington, 10; American Entomological Society, 34; Colln. of James E. Cottle, 8.

TWO SUBSPECIES OF MELANOPLUS DIFFERENTIALIS AND RELATED NEW SPECIES FROM MEXICO WITH DISCUSSION OF THEIR VARIATIONS

(ORTHOPTERA: ACRIDIDAE: CYRTACANTHACRIDINAE)

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In studying the Melanopli of Mexico, *Melanoplus differentialis* was found to be composed of two quite distinguishable subspecies, one of which occurs only within the United States. Since these grasshoppers have considerable economic and biological importance, this short paper seemed desirable in advance of the comprehensive study on Mexican Melanopli under way by the author. In addition to these two subspecies, three other closely related species, including two subspecies, are newly described or redefined from Mexico. Variations within the species are treated with more than usual detail, whether of diagnostic value or not. In this way, the behavior and possible significance of variations in a species during the evolutionary process may be brought to the attention of the biologist, who may have occasion to study these species in the laboratory.

This study is based almost entirely on the Hebard North American and the Academy of Natural Sciences of Philadelphia Collections, in which there are over 800 specimens of this group of species. The aedeagi of more than seventy-five specimens were examined, as well as examples of the female spermatheca from each of the species and subspecies.

Relationships and Nomenclature

The small cluster of species treated here belongs to the very comprehensive association called the Melanopli, of which the genus *Melanoplus* contains the large majority of species. Within this

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genus there are recognized associations of species, called species groups by Hebard and others. The limits of the group, to which *M. differentialis* belongs, may include only the forms treated here, but *M. bivitattus, M. thomasi, M. ponderosa, M. eumera,* and possibly others certainly are closely related species, as compared with other members of the genus. Of the forms treated here, a considerable degree of difference in their relationships is evident. Their relative relationship is roughly indicated in the following list by the distance of lines apart.

Melanoplus differentialis differentialis

* * *

Melanoplus differentialis nigricans[1]

* * *

* * *

Melanoplus sumichrasti sumichrasti

Melanoplus sumichrasti vicinulus n. subsp.

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Melanoplus littoralis n. sp.

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* * *

Melanoplus meridae n. sp.

The evidence for this arrangement is almost entirely based on the male cercus and aedeagus. With the exception of *M. meridae,* no other diagnostic features were found to be entirely dependable. All of these forms are geographic representatives of each other, and their distribution has not been found to overlap thus far. Unfortunately more details of their distribution are needed from eastern Mexico where the greatest amount of differentiation has taken place. *M. meridae* has certainly undergone the greatest amount of change, or, perhaps more accurately stated, is most widely distinct. *M. littoralis* in sequence is the next most distinct. These relative relationships may be seen by comparison of the figures of the aedeagi and cerci. All of the elements and general pattern are present throughout the series, but each form may be seen to have a varying degree of change in proportions, and at the same time suggests its closest ally.

[1] This name or subspecies has never been generally recognized.

Having decided the interrelationships of these forms, how best to indicate this by nomenclature becomes a problem. At first it was intended to indicate the very close relationship of these species in relation to other members of the genus by regarding them as six subspecies of one species. However, *M. meridae* showed too great a degree of differentiation to be treated as such, and also no intergrades or hybrids have been found thus far between any of the forms. This latter feature, of course, is a frequent criterion for subspecies. Incidental to this, but important, is the uncertainty concerning the oldest name, *sumichrasti*. For all of these reasons it was decided arbitrarily to treat those forms which could be distinguished by the cercus or other external features as species, and those which could only be recognized by the aedeagus as subspecies.

Description of Aedeagus

The author recently described[2] the phallic structures of the acridid subfamilies. Aside from the value of the general form of the phallus for the higher categories, the distal portion of the phallus, or rather aedeagus, has been found to be of great specific and subspecific value by a number of recent authors. Although to study the whole phallus it is necessary to remove the structure from the specimen, for the aedeagus it is only necessary to relax the end of the abdomen of a pinned specimen by hot water, then pull back the pallium and slightly pull up the phallus with a needle, to satisfactorily expose the aedeagus. The specimen may then be allowed to dry with the aedeagus in this position.

For definitions of terms of the structures of the phallus and aedeagus, refer to the author's paper,[2] mentioned above. The drawings here of the aedeagi are from the ventral aspect, or in caudal aspect in relation to the major longitudinal axis of the animal. The sclerotized arms of the cingulum, called the rami, which flank the base of the aedeagus, are omitted. The sclerotized, major part of the aedeagus are the two pairs of aedeagal valves. The ventral pair of valves (Pl. X, V–v) are reduced to a flattened pair of processes. The dorsal valves (Pl. X, D–v) are quite heavy

[2] "A comparative study of the subfamilies of the Acrididae (Orthoptera) primarily on the basis of their phallic structures." *Proc. Acad. Nat. Sci. Phila.*, XCIII, pp. 201–246, 1941.

and are distinctively shaped at the distal end. The sheath (Pl. X, Sh) is a heavy, whitish membrane which arises from the rami of the cingulum at the base of the aedeagus and flanks a large portion of the aedeagal valves. It is divided on the ventral side, as may be seen in the figures, and also along the mid-dorsal line. The sheath at its distal margin is closely connected with the dorsal valves, especially dorsad. The distal portion of the dorsal valves show the greatest amount of differentiation between the various forms as discussed beyond.

Taxonomy

Melanoplus differentialis differentialis (Thomas)
(Text-fig. 1; pl. X, fig. 2; pl. XI, figs. 8–11.)

Acridium differentiale Thomas, Tran. Illinois State Agri. Soc., v, p. 450, 1865. (Type locality: Illinois.)

Cyrtacanthacris diversifera[3] Walker, Cat. Derm. Salt. Brit. Mus., iv, p. 611, 1870. (Type locality: North America.)

For diagnosis refer to *M. differentialis nigricans* below.

Distribution.—The range of this species may be roughly seen in text-figure 1. The apparent gap in distribution between this and the western subspecies, as indicated on the map, is probably not real, but rather due to lack of collecting especially in Iowa, Missouri, and Arkansas. Also the records are weak at the eastern limits of its distribution. The certain identity of a single female from Richmond, Virginia, VIII, 19, 1940, collected by Bayard Long cannot be decided without males.

Melanoplus differentialis nigricans[4] Cockerell
(Text-fig. 1; pl. X, fig. 3; pl. XI, figs. 12–15.)

[*Melanoplus differentialis* Uhler], var. *nigricans* Cockerell, Ent. Rec., xxix, p. 247, 1917. (Type locality: Boulder, Colorado.)

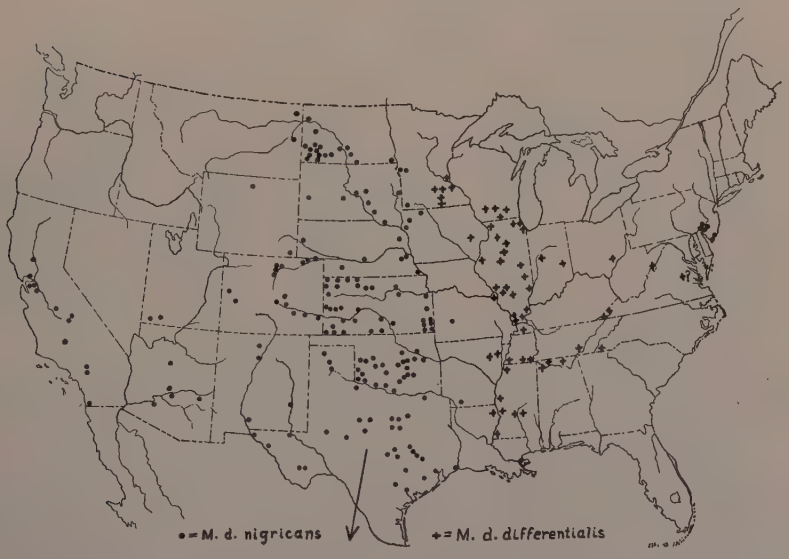
[3] Uvarov (Trans. Ent. Soc. London, li, (1), p. 298, 1925), pointed out this synonymy. There is a possibility that the type might be *d. nigricans*. Since, however, *nigricans* had not in all probability been introduced at that time to the Philadelphia region, it seems most reasonable to assume that it came from the Mississippi Valley east of the Great Plains. Unfortunately the type is a female, so that further examination of the specimen is not likely to answer the problem.

[4] Professor T. D. A. Cockerell found a melanic specimen of *M. differentialis* at Boulder, Colorado. Despite the fact that Gillette, thirteen years earlier in his annotated list of Colorado Orthoptera, states that occasional black individuals are found in all places where the species occurs, and despite the fact that such varieties or phases are customarily never given a scientific name in Orthoptera, Prof. Cockerell published a note on his find and gave it a name. The unfortunate feature of this name is that it now must be used for the western subspecies of *differentialis*, here described, which is characteristically the palest yellow member of the group.

Diagnosis.—This subspecies together with *M. d. differentialis* may be most readily recognized from other species by the form of the cercus. The most similar species is *M. sumichrasti* from eastern Mexico. Though some variation of the cercus occurs within each species, as may be seen in the figures, there is a consistent difference of proportions between them. The most easily recognized difference is that the distance between the base of the cercus and the apex of the ventro-median projection is less than the distance between the apex of the ventro-median projection and the distal apex of the cercus in *M. differentialis.* The reverse relative proportion is true for *M. sumichrasti.*

Other than the aedeagus, no constant feature has been found to separate this subspecies and *M. d. differentialis.* The principal modification here is the much greater distal production of the aedeagal valves in the nominate subspecies as compared to *nigricans,* so that both valves are more slender and the distal end of the dorsal valves project much further beyond the disto-lateral margins of the sheath. Also in *nigricans* there are always two deep channels or cavities (Pl. X, fig. 3, d and c). In *d. differentialis* the cavity (Pl. X, fig. 2, c) is obsolete and the channel (Pl. X, fig. 2, d) is much more shallow.

Distribution.—(Text-fig. 1.) The occurrence of this western



Text-figure 1.—Map of the United States showing distribution of subspecies of *Melanoplus differentialis,* excepting for Mexico.

subspecies and not the more eastern one in the vicinity of Philadelphia and southern New Jersey, strongly suggests that it has been introduced by human agency. It was first recorded by Scudder in 1897.[5] Rehn, 1900,[6] gives more extensive data, the earliest date given is 1896, and he implies that it has but recently arrived and become established in the area. This subspecies appears not to reach the Mississippi River at its normal eastern limits except at New Orleans, but, as mentioned before, further collecting is needed in the eastern limital states. To the south it occurs over much of the Mexican central plateau, nearly to Mexico City.

Definite records for Mexico:[7]

NUEVO LEON: Mamulique Pass, 1800 ft., VII, 11, 1936, 4 ♂, 1 ♀. Horse Tail Falls, east of Monterrey, 2200 ft., VII, 27, 1938, 1 ♂. Arroyo Garrapatas, 6 miles north of Montemorelos, 1600 ft., VII, 18, 1936, 1 ♂, 5 ♀. Galeana, 5000 ft., VII, 13, 1938, 1 ♂.

HIDALGO: Tula River, Tasquillo, 5500 ft., IX, 9, 1936, 1 ♂.

QUERETERO: Queretero, XI, 1887, (L. Bruner), 1 ♂, [rec. by Scudder, 1897].

GUANAJUATO: Guanajuato, XII, 11, 1898, (collector ?), 1 ♂.

MICHOACAN: Morelia, 6–8000 ft., IX, 4–5, 1938, 2 ♂. Lake Patzcuaro, 6500 ft., IX, 4, 1938, 1 ♂. Cojumatlan, Lake Chapala, 4–5500 ft., IX, 8–9, 1938, 4 ♂, 1 ♀.

JALISCO: San Luis Soyatlan, Lake Chapala, 5000 ft., VIII, 23, 1938, 1 ♂. Between Guadalajara and Chapala, 5500 ft., IX, 13, 1938, 1 ♀. Guadalajara, IX, 14, 1903, (J. F. McClendon), 4 ♂, 1 ♀.

At the localities in the vicinity of Lake Chapala it was encountered in large numbers together with *Brachystola mexicana* and *Hippiscus ocelote*.

Melanoplus sumichrasti sumichrasti (Saussure)
(Pl. X, fig. 4; Pl. XI, figs. 16–19.)

Pez[*otettix*] *sumichrasti* Saussure, Rev. Mag. Zool., XIII, p. 160, 1861. (Type locality: Mexico.)

Melanoplus sumichrasti (Saussure). Bruner, Biol. Cent.-Amer., Orth. II, p. 326, 1908, (in part, not Merida, Yucatan). Hebard,[8] Trans. Amer. Ent. Soc., LVIII, p. 288, 1932.

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[5] Proc. U. S. Nat. Mus., XX, p. 353, 1897.
[6] Canadian Ent., XXXII, p. 28, 1900.
[7] Unless otherwise stated, all material was collected by the author.
[8] Hebard also records a specimen from Coatepec, Ver., as *M. differentialis*. Though I have not seen the specimen, as it is in Mexico City, it is most probably *M. s. sumichrasti*.

The application of this name to this subspecies with certainty must await examination of Saussure's material in Geneva. Bruner has examined two specimens of Saussure's species (cotypes ?) and considers one of them as the type (loc. cit.). Bruner also figured the cercus of this selected "type" specimen. With this information and Saussure's description of the color, it is evident that the name applies either to this subspecies or *M. s. vicinulus*. Now since Sumichrast collected extensively around Cordoba and Orizaba, and I have a specimen from San Rafael, just to the northwest of Cordoba, of this subspecies, it is most reasonable to apply the name thus, until at least the aedeagi of the type material can be examined.

Diagnosis.—This subspecies and *M. s. vicinulus* may be distinguished from *M. differentialis* by the cerci, as described under *M. d. nigricans*. The coloration of these two subspecies are characteristically very dark; hind tibiae with distal two-thirds dark orange red, and proximad fuscous black with a yellow annulus; hind femora with pagina largely black or fuscous with prominent, bright yellow stripe along ventral margin; proximal half of venter of hind femora orange red. These color features, however, are not dependable, since both these subspecies (*M. s. sumichrasti* and *M. s. vicinulus*) have at least in some parts of their range individuals with the lighter general coloration and/or the red of the hind tibiae and femora replaced by yellow, as usually found in other species.

For diagnosis of this subspecies and *M. s. vicinulus* on the basis of the aedeagi refer to the latter subspecies below, and see plate X, figs. 4 and 5.

Distribution.—Mexico, from lower foothills of the Eastern Sierras up to 6500 ft., and between extreme southern Tamaulipas to vicinity of Cordoba, Veracruz.[9]

TAMAULIPAS: Between Villa Juarez and 35 miles south, 400–1000 ft., VII, 24, 1936, 1 ♂, 4 ♀,[10] 4 juv. ♀.

SAN LUIS POTOSI: 5 miles west of Naranjos near Rio Salto, 500 ft., VIII, 30, 1940, 1 ♂, 2 ♀. Tamazunchale, VIII, 29, 1936, (E. D. Ball), 1 ♂. Between Tamazunchale and Chapulhuacan, 1500–2000 ft., VII, 29, 1936, 1 ♀.

HIDALGO: Santa Ana, 4–5000 ft., VII, 27, 1936, 2 ♂. Zacualtipan, 6500 ft., VIII, 9, 1938, 1 ♂, 1 ♀. Tianguistengo, 5500 ft., VIII, 13, 1938, 1 ♂.

PUEBLA: Necaxa, 925 m., VII, 28, 1926, (H. B. Baker), 2 ♂, [rec. by Hebard, 1932].

VERACRUZ: San Rafael near Cordoba, (Townsend), 1 ♂.

[9] Unless otherwise indicated, all material was collected by author.
[10] Three of the females have yellow rather than red hind tibiae.

The male from San Rafael is much paler or more yellowish in general coloration than others of the subspecies, and the hind femora lack much of the black pigmentation, suggesting *M. littoralis* in this respect. The hind tibiae are red, however.

Melanoplus sumichrasti vicinulus[11] new subspecies
(Pl. X, fig. 5; pl. XI, figs. 20–23.)

The east central, Mexican highland representative of *M. s. sumichrasti.*

Type.—♂; 3–8 miles north of Jacala, Km. 285, Hidalgo, Mexico. Elevation 5–6000 ft. September 10, 1936. (H. R. Roberts.) [Acad. Nat. Sci. Phila., Type no. 5677.]

Diagnosis.—Similar in all respects to the nominate form except for the apex of the aedeagus, and the average smaller size of individuals. Comparing the aedeagal figures 5 and 6 of the two subspecies, there appears to be considerable difference. However, variations in other specimens more nearly bridge this gap. The end of the projection (a, Fig. 5) of the dorsal valves in *vicinulus* may become more pointed, but it is never sharply divided from the outer distal portion (b) as in *sumichrasti* (Fig. 4).

Coloration.—(Type) General color dark fuscous brown. Anterior portion of dorsal half of lateral lobes of pronotum blackish. Meta-episternum with contrasting, dull yellowish stripe. General pattern of hind femora similar to *differentialis* except paginae are almost entirely fuscous black with a heavy bright yellow stripe along the ventral margin. Ventrad of stripe black. Proximal half of venter of hind femora, and distal two thirds of hind tibiae orange red. Proximal portion of tibiae fuscous black with a dull yellowish brown annulus.

Allotype.—♀; same data as type. [Acad. Nat. Sci. Phila.]

Similar in general form and color to male except reddish areas on hind tibiae and femora replaced by yellow. Other females, however, from the same locality have red coloration of male.

Measurements.—(Type and allotype.) Length of body ♂ 15, ♀ 15.5; length of pronotum ♂ 6.5, ♀ 8.2; length of tegmina ♂ 18.5 + (broken), ♀ 23; length of hind femora ♂ 16.5, ♀ 19.5 mm. Tegmina are slightly short of or barely surpass ends of hind femora.

Material examined.—Same locality as type: VII, 21, 1940, 1♀; VII, 30, 1936, 3♂, 2♀; VIII, 28, 1940, 1♂, 2♀; IX, 10, 1936, 3♂, 1♀, 2 juv. ♀, (including type and allotype). Tlalpam, D. F., 7500 ft. IX, 5, 1936, 1♂. All collected by author.

The male from Tlalpam has the red of the hind legs replaced by yellow.

[11] vicinus (neighbor) + ulus (a diminutive).

Melanoplus littoralis [12] new species (Pl. X, fig. 6; pl. XI, figs. 24–27.)

Melanoplus differentialis (Thomas), Bruner, Biol. Cent.-Amer., Orth. II, p. 326, 1908 (in part: Veracruz ?). Hebard, Proc. Acad. Nat. Sci. Phila., p. 269, 1917, (in part: 2 ♂, Veracruz and 2 ♂, 5 ♀; Medellin, Ver.).

At present known only from the vicinity of Veracruz City, Mexico. The form of the aedeagus suggests that its nearest ally is *M. s. sumichrasti.*

Type.—♂; Veracruz, Veracruz, Mexico. (Crawford.) [Acad. Nat. Sci. Phila., Type no. 5678.] [13]

Allotype.—♀; Medellin, Veracruz, Mexico. October, 1895. [Acad. Nat. Sci. Phila.]

Diagnosis.—Most easily recognized by male cercus. The ventro-median projection has become a more pronounced tooth-like process (Figs. 24–27). The aedeagus shows much modification. The pointed processes of the dorsal valves (Fig. 6, a) are present, as in *sumichrasti* (Fig. 4, a), but the adjacent portions are more simple and reduced. The ventral valves are more obliquely truncate and the sheath has a distinctive form.

Measurements.—(Type and allotype.) Length of body ♂ 33, ♀ 43; length of antennae ♂ (lacking), ♀ 19; length of pronotum ♂ 6.8, ♀ (damaged); length of tegmina ♂ 25, ♀ 30; length of hind femora ♂ 17.5, ♀ 24 mm. Tegmina of ♂ extend to, and in ♀ slightly beyond end of hind femora.

Material examined: Besides type and allotype; from Medellin, Ver., 1 ♂, 1 ♀, September and 1 ♀ November; Veracruz, Ver., (T. Hyde), 2 ♀.

Other than the features mentioned above, it is quite similar in form and color to a dull colored *M. d. differentialis.* None of the specimens have red on the hind tibiae or femora.

Melanoplus meridae [14] new species (Pl. X, fig. 7; pl. XI, fig. 28.)

Melanoplus sumichrasti (Saussure). Bruner, Biol. Cent.-Amer., Orth. II, p. 326, 1908, (in part: Merida, Yucatan).

The only species of the association which has structural modifications other than the male cercus and aedeagus. Probably nearest allied to *M. littoralis,* but there may be other unknown forms from intervening geographical areas.

Type.—♂; Merida, Yucatan, Mexico. (Gaumer.) [Acad. Nat. Sci. Phila., Type no. 5679.]

Allotype.—♀; same data as type. [Acad. Nat. Sci. Phila.]

[12] An allusion to its apparent coastal distribution.

[13] As this specimen came from the Collection of L. Bruner, it may well be the basis of his locality record of *M. differentialis,* cited above.

[14] An allusion to the type locality.

Diagnosis.—The eyes of the male are markedly more protuberant and the interocular space proportionally narrower than the other species. Also the disk of the pronotum is shorter and proportionally narrower cephalad. These features are evident in the female to a much less marked degree. The male cercus (Fig. 28) is distinguished by the narrowly pointed distal end. The aedeagus (Fig. 7) shows a rather radical modification of the dorsal valves. The ventral valves and sheath still resemble the general form of the other species.

Coloration.—(Type.) Dark fuscous brown. Dull yellowish stripe on meta-episternum quite prominent. Yellow stripe on ventral margin of pagina of hind femora strongly developed. The dark coloration of pagina is broken by two large diagonal brown spots. Ventral surface of hind femora and most of hind tibiae dull red. Proximal portion of hind tibiae dull yellowish brown.

(Allotype.) Quite similar to male except sides of tegmina have small scattered fuscous spots.

Measurements.—(Type and allotype.) Length of body ♂ 29, ♀ 40; length of antennae ♂ 15, ♀ 15.5; length of pronotum ♂ 6, ♀ 8.7; length of tegmina ♂ 25, ♀ 29 +; length of hind femora ♂ 15, ♀ 21 mm. Tegmina extend in ♂ 5 mm., in ♀ end broken, but in other specimens 2–3 mm. beyond hind femora.

Distribution.—Known only from type locality. In addition to the type and allotype, there are 3 ♀ with same data.

Description of Variable Characters

The variable features described below are not characters that can be used as criteria for any of the particular species or subspecies treated here, though many such features are frequently diagnostic for other groups and species. Since modifications of the reproductive structures are the major basis for the taxonomic units here and are constant for the units, these variable features are therefore not directly correlated or linked with those changes of the reproductive structures. There is no reason to believe, however, that any of these "variable features" may not become fixed and diagnostic for one or more of the taxonomic units at some future time, but their behavior does suggest that they are of a different evolutionary level than the reproductive structural changes.

General Coloration

The degree of pale or dark, general body coloration differs considerably over different geographical areas. Specimens from any given area are usually quite uniform, though a complicating factor

in making such comparisons is the varying degree of color preservation, especially among the paler examples. Also, the age of an individual when collected may be a variable factor.

The range of variation in the United States is from dark yellow olive to pale yellow. The most brilliantly colored ones are rich chrome yellow. Specimens of *d. differentialis* are never as pale as those found among *d. nigricans,* and material of the former from Louisiana, Mississippi, and Alabama show an unusual amount of black pigmentation on the hind femora. Material of *d. nigricans* from the more arid parts of the Great Plains and to the west are usually the palest. Those having red hind tibiae from California show the most extreme paleness and lack of black pigmentation. Material of *d. nigricans* from Mexico shows much variation, especially in the degree of black pigmentation of the hind femora.

The two subspecies of *sumichrasti* from east central Mexico are as a rule extremely dark with most of the yellowish ground color obscured, and a large amount of black pigmentation present. However, a lone specimen from Mexico City and one from San Rafael, Veracruz, each representing one of the subspecies, show a much lighter ground color and the latter specimen has the black pigmentation much more reduced.

Melanoplus littoralis from the coast of Veracruz (8 specimens) shows extensive black pigmentation, but the ground color is much lighter or more intense yellow than most examples of the two subspecies of *sumichrasti. M. meridae* has extensive black pigmentation and the ground color appears to be dull fuscous brown, but this latter feature appears to be partly due to poor preservation.

There is a rough correlation evident between aridity and paleness, and humidity and darkness. Whether temperature is also a factor is not clear.

Coloration of Hind Tibiae

Melanoplus d. differentialis. Characteristically yellow. Those from northern limits of range, i.e. Minnesota, Wisconsin, Illinois, tend to be pale yellow, and those from southern limits, i.e. Louisiana, Mississippi, Alabama, orange red. None that might be called red have been seen.

Melanoplus d. nigricans. Characteristically yellow. One female labelled Tinicum, Delaware Co., Pennsylvania has red legs (only specimen out of 44 from this area so colored). One male from Spanish Fort, Louisiana has red legs. Only other specimen collected nearby has yellow legs. All red legged (35 specimens) in California, except those from the two most northern and three most southern localities, i.e. Grimes, Davis, Colton, Riverside, and Tia Juana (10 specimens).

Melanoplus s. sumichrasti. Characteristically dark red (15 specimens). From between Villa Juarez, Tamps, Mex. and 35 miles south, 3 ♀ have dark yellow legs and 1 ♂, 1 ♀ have red legs. This locality is the northernmost record for the subspecies.

Melanoplus s. vicinulus. Characteristically red (12 specimens). The allotype female from Hidalgo and one male from Tlalpam near Mexico City has yellow legs. No other specimens from the latter area.

Melanoplus littoralis. All known (8 specimens) yellow legged.

Melanoplus meridae. All known (5 specimens) red legged.

The most noteworthy feature of this variation is its constancy, with but few exceptions, over a geographical area. What is the nature or determining factor of one color or the other of the hind tibiae is not clear. Breeding experiments should produce interesting evidence.

Melanism

I have seen melanic individuals of *M. d. nigricans* from Minnesota, Iowa, North and South Dakota, Nebraska, Kansas and Colorado only. This variation, so far as I am aware, is relatively very scarce in areas where found. R. L. King [15] reports that breeding tests show the melanic form to be determined by a single recessive gene. It should be noted that no species of the genus *Melanoplus* is distinguished systematically by such melanic coloration.

Size Variation

Great differences of gross size are quite apparent, but these differences are not indicative of any of the subspecies. For example, specimens of *d. nigricans* from Texas usually are as large

[15] Genetics, XXVII, no. 1, p. 151, 1942.

or larger than any other specimens of the group before me. Yet from the Dakotas this same subspecies becomes as small as any individuals among the other subspecies. A series of individuals collected at any one locality are fairly uniform in size. Material from the northern limits of *nigricans* and *differentialis,* as well as that of *s. vicinulus* from the highlands of central Mexico, are very markedly smaller than those from most other localities. This would suggest some correlation with an environmental factor or factors. Whether these differences in size are inherited could be well demonstrated by rearing under controlled conditions. The fact that individuals from one locality do occasionally show sharp contrast in size to a series from another quite adjacent locality, would suggest that these differences may depend directly on the favorable or unfavorableness of the immediate environment.

Variation in Proportions

An attempt was made to determine if there were any changes in relative sizes of structures between different geographical areas of the same species and between species or subspecies. The ratio between the length of the hind femur and the greatest distance across eyes and head in dorsal aspect was selected, because of relative ease of measurement, and because, if there was any tendency for the animal to become slender or elongate, the head would usually become narrower and the femora longer.

Using a dissecting microscope with a mechanical stage calibrated to a .1 mm., a series of 15 ♂ from Bexar Co., Texas of *M. s. nigricans* were first measured. Then examples from other localities of *nigricans* were likewise measured, and also a number of specimens from each of the other species or subspecies. The series from Bexar Co. were relatively uniform in gross size. Still the degree of variation of the ratio between the two measured structures from this one locality was found to nearly include the maximum and minimum ratios of all others measured. It is possible with larger series from Mexico that some significant differences could be found. However, the results from measuring some forty specimens did not seem to warrant further investigation or the recording of the data here.

Significance of Reproductive Structure Changes

Since the modifications of the reproductive structures (male cercus and aedeagus) are here assumed to be the primary basis for the recognition of the taxonomic divisions in this group of species, reasons for such an assumption are perhaps desirable. A simple concept of a species may be stated as an interbreeding population which does not normally cross with other populations, and has acquired some distinguishable character by which it may be recognized. My concept of a subspecies as compared to that of a species is that the former shows a lesser degree of modification and may in limited areas cross with other subspecies. This lower category is used here to show degree of relationship or structural change only, since no evidence of interbreeding has been found.

In cases of geographic isolation of two populations, it is obvious that no crossing can take place. In cases where populations meet or overlap in distribution, a blending of characters would be expected, if crossing did occur. Of the species treated here none apparently overlap in distribution, but most of them very nearly meet the distribution of others. In spite of this, there is no evidence of blending or modification of the reproductive characters to suggest crossing.

The reproductive characters show a relative constancy throughout the geographical range of one species and show an abrupt change in the next adjacent species. To illustrate this a series of drawings of the male cercus of each of the forms, Figs. 8–28, were made. Where possible, four widely separated localities were selected for each of the species or subspecies and an example from each locality was chosen at random. Comparing the cerci of the four species (not the subspecies), a characteristic form is quite evident for each species. Though some latitude of individual variation is evident, there is no question as to which form each example belongs. It is necessary, however, to use the aedeagus to distinguish the two pairs of subspecies. The aedeagus behaves in a similar manner to the cercus and could likewise be illustrated.

Considering the nature of these reproductive modifications, or comparing them with what are termed here as variable characters, these structures are, of course, part of or associated with the re-

productive system, which at once suggests that they are closely correlated with changes which prevent interbreeding. There has been some recent literature on other groups of insects to indicate that a block in fertility between populations is one of the first changes to develop in the formation of new species. Moreover these structures are apparently not modified by any environmental local condition, nor do they behave as a variant or mutation, as in the case of melanism. In addition to this, these reproductive structures have been very successfully used as diagnostic characters for most other species of *Melanoplus* and allied genera. For these reasons the modifications of these structures appear to be of critical importance for the recognition of taxonomic units, and, as suggested before, are probably determined by a different evolutionary mechanism than those modifications described as variable characters, which behave either as simple mutants in a population, or responses to some environmental factors.

Further discussion of these evolutionary problems here is not justified by the amount of evidence presented. However, it may be said that from unpublished studies already made on the Mexican Melanopli by the author, the general picture is much the same as described here. In this forthcoming treatment of the Melanopli it is planned to greatly amplify the many as yet unexplained phenomena as seen by the taxonomist. The geneticists have valiantly attacked the problem, but as yet their answer is far from complete.

Explanation of Figures

Plate X

Ventral aspect of aedeagi. D–v. = Dorsal aedeagal valves. V–v. = Ventral aedeagal valves. a–c. = Homologous parts of aedeagus

Fig. 2.—*Melanoplus d. differentialis,* 3 mi. east of Bolivar, Hardeman Co., Tennessee, U. S., 450 ft., VIII, 9, 1939, (Rehn & Rehn).

Fig. 3.—*Melanoplus d. nigricans,* Cherokee Co., Kansas, U. S., 888 ft., 1915, (R. H. Beamer).

Fig. 4.—*Melanoplus s. sumichrasti,* between Villa Juarez and 35 mi. south, Tamaulipas, Mexico, 400–1000 ft., VII, 24, 1936, (Roberts).

Fig. 5.—*Melanoplus s. vicinulus.* (Type.)

Fig. 6.—*Melanoplus littoralis.* (Type.)

Fig. 7.—*Melanoplus meridae.* (Type.)

PLATE XI

Left cerci of males

Melanoplus differentialis differentialis

Fig. 8.—2 mi. north of Franklin, Pendleton Co., West Virginia, U. S., 1500 ft., IX, 4, 1938, (J. W. H. Rehn).
Fig. 9.—Fish hatchery, St. Peter, Minnesota, U. S., VIII, 11, 1923, (Sam Kepperly).
Fig. 10.—Fulton, Kentucky, U. S., VIII, 11, 1897.
Fig. 11.—5 mi. east of Tallulah, Madison Parish, Louisiana, U. S., 60 ft., IX, 1, 1939, (Rehn & Rehn).

Melanoplus differentialis nigricans

Fig. 12.—Mandan, North Dakota, U. S., VII, 16, 1933, (L. A. Carruth).
Fig. 13.—Bexar Co., Texas, U. S., VII, 28, 1929, (H. B. Parks).
Fig. 14.—Jewetta, Bakersfield, California, U. S., 450 ft., IX, 1, 1922, (Rehn & Hebard).
Fig. 15.—Cojumatlan, Lake Chapala, Michoacan, Mexico, 4–5500 ft., IX, 8–9, 1938, (Roberts).

Melanoplus sumichrasti sumichrasti

Fig. 16.—5 mi. west of Naranjos on Rio Salto, San Luis Potosi, Mexico, 500 ft., VIII, 30, 1940, (Roberts).
Fig. 17.—Santa Ana, Hidalgo, above Tamazunchale, Mexico, 4–5000 ft., VII, 27, 1936, (Roberts).
Fig. 18.—Zacualtipan, Hidalgo, Mexico, 6500 ft., VIII, 9, 1938, (Roberts).
Fig. 19.—San Rafael, Veracruz, Mexico, (Townsend).

Melanoplus sumichrasti vicinulus

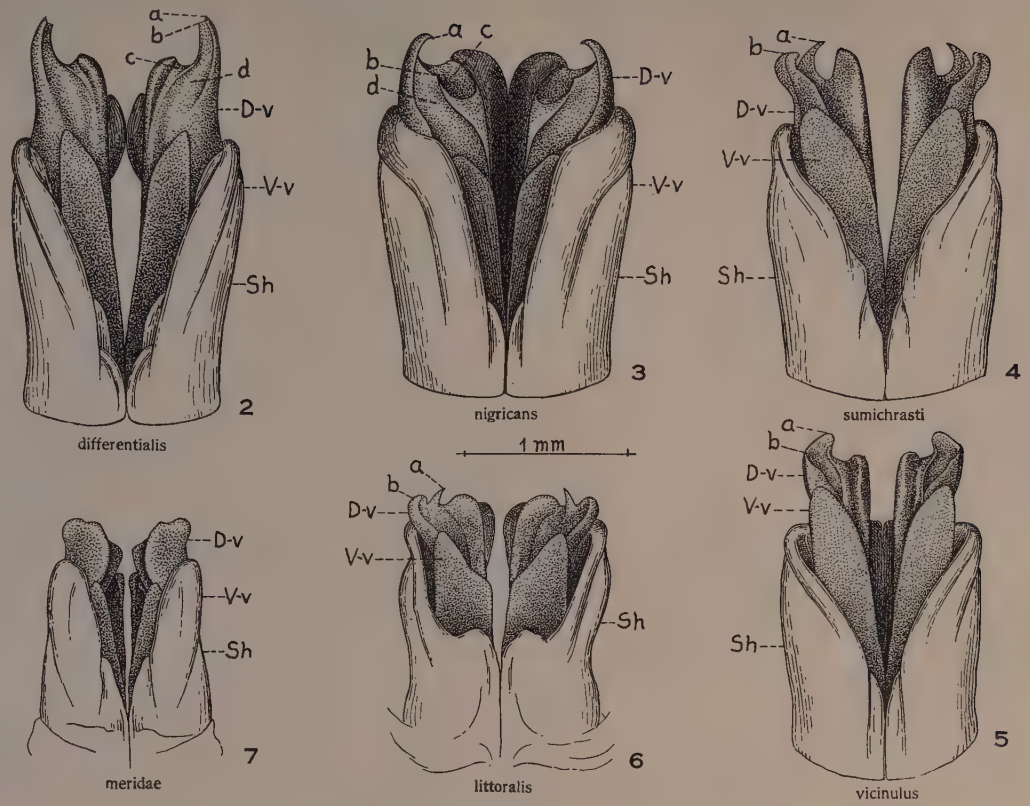
Figs. 20–22.—3–8 mi. north of Jacala, km. 285, Hidalgo, Mexico, 6000 ft., VII, 30, 1936, (Roberts).
Fig. 23.—Same locality as above, VIII, 28, 1940.

Melanoplus littoralis

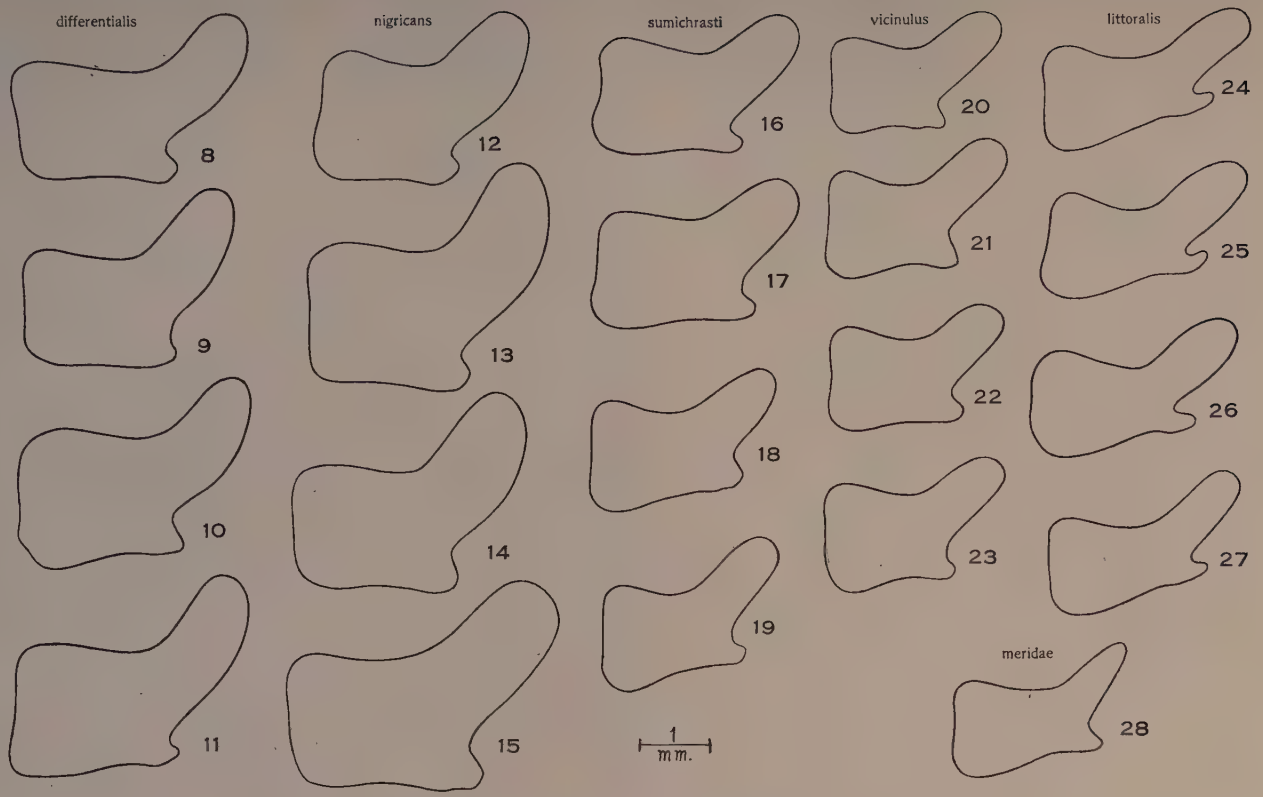
Fig. 24.—Medellin, Veracruz, Mexico, IX, 1895.
Figs. 25, 26.—Veracruz, Veracruz, Mexico, (T. Hyde).
Fig. 27.—Veracruz, Veracruz, Mexico, (Crawford).

Melanoplus meridae

Fig. 28.—(Type) Merida, Yucatan, Mexico, (Gaumer).



ROBERTS—MELANOPLUS DIFFERENTIALIS



ROBERTS—MELANOPLUS DIFFERENTIALIS

ON THE LOCUST GENUS PSOLOESSA
(ORTHOPTERA; ACRIDIDAE; ACRIDINAE)

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(Text-figures 1 to 57)

Among studies planned by me a score of years past was a systematic revision of the species of the genus *Psoloessa,* and of this much of the preliminary work was then blocked out and some of the detailed analyses required were completed. Limitations on research time imposed by various responsibilities then compelled me to lay this work aside, and except for the description of one subspecies in 1937 [1] none of the results of the study has as yet been published.

In the meantime a change in the method originally adopted had been found desirable, and the general plan of the investigation was materially altered. The contribution now presented includes the chief elements of the study of the genus as originally planned, but these have been condensed in certain respects, one of which is that the exceptional range of variation found in certain elements of the genus is discussed in detail for but a single, yet fully representative, form.

The matter here presented is divided into sections dealing with specific phases of the study, grouped as follows:

I. The Genus Psoloessa, its Relationships and a Key to the North American Forms; II, A New Species from California; III, A New Subspecies of Psoloessa texana; IV, Forms occurring in the United States, their Synonymy, Original Material and Individual Distributions; V, Morphological, Size and Color Variation in and Bionomics of Psoloessa delicatula delicatula.

[1] "A New Subspecies of Psoloessa delicatula (Orthoptera: Acrididae)." *Trans. Amer. Entom. Soc.,* LXIII, pp. 325–332, (1937).

TRANS. AMER. ENT. SOC., LXVIII.

Issued December 9, 1942 1101:175

This set of studies has been restricted to those forms of *Psoloessa* which occur in North America north of Mexico, but the distribution of these to the southward in Mexico has been treated in equal detail. A number of Mexican and South American species which have been described as members of the synonymic genus *Stirapleura* are not here considered, as I have already shown the proper position of several of the Mexican forms is in the related genus *Scyllina* [2] and others I had previously referred to the South American genus *Scyllinops*. Others still unplaced in a more modern generic classification are equally distinct generically from the genotype of *Psoloessa*. Consideration of the latter forms will involve genera not treated in the present study, and these must await future consideration. All known forms clearly referable to *Psoloessa* are discussed in the following pages.

Acknowledgment is here made to the American Philosophical Society for its cooperation by grants from the Eldridge Reeves Johnson Fund in partial support of field studies made in the southwestern United States in 1937 and 1939, and in Mexico in 1940, some of the material results of which have been utilized in the present contribution. My thanks are also due the authorities of the Zoological Museum of the University of Michigan, and of the Department of Entomology of the University of Kansas, for the loan of certain material reported in this paper, and also to my colleagues, Mr. Morgan Hebard and Dr. H. Radclyffe Roberts, for their cooperation and courtesy in placing in my hands for examination series of *Psoloessa* which formed parts of extensive collections in the study of which they are at present engaged.

In connection with the present study I have had before me at various times many hundreds of specimens. A count of those examined in the final work on this paper gave a total of 2465, of which somewhat over 2000 are in the Philadelphia collections. The smallest series then available was that of *Psoloessa delicatula buckelli,* which totalled 41 specimens, the largest that of *P. delicatula delicatula* which numbered 993.

[2] See Trans. Amer. Entom. Soc., LXVI, pp. 110–114, (1940).

I. The Genus Psoloessa, its General Relationships and a Key to the North American Forms

PSOLOESSA Scudder

1875. *Psoloessa* Scudder, Proc. Boston Soc. Nat. Hist., XVII, p. 512.
1876. *Scyllina* Scudder, Bull. U. S. Geol. Surv. Terr., II, no. 3, p. 263. (Not of Stål, 1873.)
1876. *Dociostaurus* Scudder, Ann. Rep. Chief of Engineers, U. S. Army, 1876, Append. JJ, p. 507. (Also in Wheeler, Ann. Rep. Geogr. Surv. W. 100th Merid., 1876, p. 287.) (Not of Fieber, 1853.)
1876. *Stirapleura* Scudder, Ann. Rep. Chief of Engineers, U. S. Army, 1876, Append. JJ, p. 510. (Also in Wheeler, Ann. Rep. Geogr. Surv. W. 100th Merid., 1876, p. 287.)

GENOTYPE (by selection of Kirby, 1910[3]): *Psoloessa texana* Scudder. The genotype of *Stirapleura* is, by monotypy, *Stirapleura decussata* Scudder (=*Psoloessa delicatula*).

Synonymy.—The synonymy of *Stirapleura* under *Psoloessa* was first indicated by Hebard in 1928[4] by reference to my unpublished conclusions on the subject. No detailed discussion of this matter is necessary, as the difficulty of separating *Psoloessa* into two units, to one of which the name *Stirapleura* might be applied, is clearly illustrated by the uncertainty of all authors, beginning with Scudder in the seventies, as to which generic name should be used for species here considered congeneric. A perusal of the synonymy given under individual forms on subsequent pages will make this point clear. Scudder in 1897 in his classic "Guide"[5] gives as differential generic features, the presence in *Stirapleura* of a single or double series of carinae on the lateral lobes of the pronotum, and their absence in *Psoloessa;* in the face in *Stirapleura* being "nearly perpendicular" and "distinctly and considerably oblique" in *Psoloessa,* while the frontal costa is said by him to be "sulcate throughout, acuminate at vertex and regularly divergent below" in *Stirapleura,* and "not sharply acuminate above and scarcely sulcate at any point" in *Psoloessa.* His efforts to follow these definitions led him to place his subsequently described *pusilla* in *Stirapleura,*

[3] Synon. Catal. Orth., III, p. 129.
[4] Proc. Acad. Nat. Sci. Phila., LXXX, p. 231.
[5] Guide to the Genera and Classification of the North American Orthoptera found North of Mexico. 1897. Pages 31–32.

although its diverse components were, as explained beyond under *Psoloessa thamnogaea,* representatives of a quite distinct genus, of a species unquestionably congeneric with *Psoloessa texana,* (i.e. *P. thamnogaea*) and of a subspecies now known to intergrade with restricted *texana.* The criteria given in 1897 cannot be maintained as generic differential features, as even demonstrated subspecies of single species, i.e. of *P. delicatula,* on which *Stirapleura* was based, and of *P. texana,* the genotype of *Psoloessa,* show coverage of the extremes within specific limits, or individual variation alone nullifies their value. In consequence there is no escaping the synonymy of *Stirapleura* under *Psoloessa.*

Relationship and Position of Genus.—Only a full and comprehensive study of all the American genera which may be referred to collectively as the borderland genera of the Acridinae (Truxalinae of older authors), will enable us to speak with finality as to whether or where a line can be drawn between the Acridinae and the Oedipodinae, and also how the genera of this inexact limbo are related to one another. Scudder's uncertain movement of some of these genera clearly testified to his doubt as to their subfamily position, although the difficulty is really more fundamental, and involves the question as to whether the two classic groups are actually separable.

Roberts, from internal genitalic evidence of the male sex, recently concluded [6] that "no satisfactory means of distinguishing the Acridinae from the Oedipodinae has been found. The two subfamilies, as a single group, form a relatively homogeneous division. Whether these should be ultimately reduced to one subfamily or even divided into more than two, is not possible to state from our present information." The subfamily position of *Psoloessa* is thus controlled by whatever decision may be made as to the proper association of a considerable group of genera.

As to the generic group association of *Psoloessa,* in 1927 I proposed the group Psoloessae [7] to include it, splitting this off from another assemblage then called the Aulocari, which includes *Ageneotettix, Eupnigodes, Zapata, Drepanopterna* and *Aulocara.* These

[6] Proc. Acad. Nat. Sci. Phila., XCIII, p. 238, (1941).
[7] Trans. Amer. Entom. Soc., LIII, p. 215.

segregations were based entirely on the evidence of North American genera, and more recently made studies of South and Central American genera show that the consideration of the latter groups brings out additional angles of relationship.

Without necessarily abandoning the group Psoloessae I found in a recent study [8] that a near relation of *Psoloessa* is the south Mexican and South American genus *Scyllina,* and that from this we have a continued sequence of other South and Central American genera, namely *Scyllinops, Borellia* and *Rhammatocerus* (= *Scyllina* of authors, but not of Stål, 1873). South Mexican species which had been referred to *Stirapleura* by L. Bruner we now know belong to *Scyllina,* and South American ones described by the same author as species of *Stirapleura* have similarly been shown by me to be members of the genus *Scyllinops.* It is now evident that the nearest relative of *Psoloessa* is *Scyllina* Stål, the genotype of which is *S. peragrans* (Stål), described from Puna Island in the Gulf of Guayaquil, Ecuador.[9]

When compared with *Scyllina peragrans* the forms of *Psoloessa* show the following features, which can be considered the comparative differential criteria: Antennae shorter, of male definitely less than one and one-half times as long as head and pronotum combined (in *Scyllina* nearly or quite equal to one and one-half times the same combined length); disk of fastigium in both sexes more excavate, cephalic and lateral margins of same more clearly defined and elevated; caudal femora stouter, more inflated, pattern of external paginae more deeply impressed, less regular and more bi-imbricate; [10] carinae of caudal femora higher and sharper, and dorso-external face of caudal femora definitely broader; longer one of distal internal calcaria of caudal tibiae with distal portion evenly arcuate and more slender, tapering in depth distad, not sharply hooked and not deeply falcate throughout as in *Scyllina.*

[8] Trans. Amer. Entom. Soc., LXVI, p. 111, (1940).

[9] For a full description and figures of this species, see Rehn, Trans. Amer. Entom. Soc., LXVI, p. 108, text-fig. 4, pl. III, figs. 1 and 2, (1940).

[10] In *Scyllina* this pattern is smoothly rounded and regular, much as in *Rhammatocerus* (= *Scyllina* of authors, but not of Stål, 1873).

Key to North American Species of Psoloessa

The plasticity of certain of the forms of this genus is sufficiently great to make the construction of a workable key exceedingly difficult. Color, for obvious reasons, cannot be utilized, external genitalic features are quite similar, and the range of structural variation is so great, at least within those forms of which extensive series are available, as to make these characters hard to draw upon in a conclusive fashion. It is thus necessary to express certain differences on the "average" basis. The plasticity found in long series, and the fact that occasional individuals will negative one average feature of a form but show in all the other criteria their correct relationship, makes the association of certain specimens quite difficult. The illustrations which accompany the present study should prove of particular value in supplementing the key.

It must be understood that this key to the various subspecies is based upon material of each one of these as represented in the area over which it is considered to be typical. Atypical material, from peripheral areas of instability of type, or that from territory populated by intermediates between subspecies, can properly be evaluated and placed only by comparative study, and preferably physical comparison with typical material of the subspecies involved.

1. Form proportionately heavier and broader (for genus). Genae, as seen in cephalic aspect, more tumid, the width across eyes never equal to (♂) or markedly less than (♀) that across genae. Fastigium, as seen from dorsum, broader, the excavate portion caudad to the transverse impression broader in both sexes than the length of the same.....2

   Form very slender (for genus). Genae, as seen in cephalic aspect, less tumid, the width across eyes equal to (♂) or but slightly less than (♀) that across genae. Fastigium, as seen from dorsum, very narrow, exceedingly so in the male sex, the excavate portion caudad to the transverse impression appreciably (♂) or slightly (♀) longer than its greatest breadth. (Face markedly arcuate in profile, definitely retreating; fastigio-facial angle very narrowly rounded. Angle of fastigial outline, as seen from dorsum, sharply acute-angulate in both sexes. Frontal costa relatively narrow.).....*thamnogaea* new species

2. Form heavy. Fastigium of female, as seen from dorsum, with excavate portion markedly transverse. Frontal costa, as seen in cephalic aspect, broad, as a whole evenly expanding ventrad. Pronotum with lateral carinae, when evident, markedly clepsydral.....3

   Form of medium build. Fastigium of female, as seen from dorsum, with excavate portion less markedly transverse. Frontal costa, as seen in

cephalic aspect, relatively narrow, a considerable section immediately dorsad of the median ocellus with lateral margins subparallel. Pronotum with lateral carinae, when evident, as a whole less markedly clepsydral (except by variation in *P. t. pusilla*).....4

3. Form proportionately less compressed, broader and less attenuate, whole body not as deep. Face in profile more vertical. Fastigium less produced cephalad, and in male with bounding margins nearly or quite rectangulate as seen from dorsum. Pronotal disk less elongate, with lateral carinae averaging strongly clepsydral;[11] lateral lobes of pronotum deeper than long. Caudal femora more robust and less slender. *delicatula delicatula* (Scudder)

Form proportionately longer, more compressed, narrower and more attenuate, whole body relatively deep. Face in profile less vertical, more retreating. Fastigium more produced cephalad, and in male with bounding margins distinctly acute-angulate as seen from dorsum. Pronotal disk more elongate, with lateral carinae less strongly clepsydral; lateral lobes of pronotum subquadrate. Caudal femora more slender and elongate.....*delicatula buckelli* Rehn

4. Fastigium, as seen from dorsum, proportionately narrower in both sexes, its excavate disk cephalad of the transverse impression not definitely transverse. Pronotum with lateral carinae appreciably clepsydral, their divergence cephalad of their median approximation much more marked. *texana pusilla* (Scudder)

Fastigium, as seen from dorsum, proportionately broader in both sexes, its excavate disk cephalad of the transverse impression definitely transverse. Pronotum with lateral carinae less definitely clepsydral, their divergence cephalad of their median approximation less marked.....5

5. Fastigium, as seen from dorsum, not as broad, and its cephalic border somewhat more sharply angulate in outline. Fastigio-facial angle more pronounced in profile. Frontal costa averaging narrower. Lateral carinae of pronotum in cephalic portion averaging less subparallel and with their cephalic divergence more evident. Candal margin of pronotal disk nearly rectangulate, with the immediate median angle sharply marked.....*texana texana* Scudder

Fastigium, as seen from dorsum, averaging broader, and its cephalic border blunter in outline. Fastigio-facial angle more rounded in profile. Frontal costa averaging broader. Lateral carinae of pronotum in cephalic portion averaging more nearly subparallel and less diverging cephalad than in alternate category. Caudal margin of pronotal disk averaging more broadly obtuse-angulate, with the immediate median angle less emphasized.....*texana pawnee* new subspecies

[11] The occasional suppression of the lateral carinae of the pronotum in this subspecies is fully discussed elsewhere in this paper in the analysis of morphological variation in *P. d. delicatula.*

II. A New Species from California

The fact that the following well-marked species had been confused with forms of the genus occurring to the eastward, has been known to me for a number of years. In 1899 Scudder described the species *Stirapleura pusilla,*[12] basing it on a series of eighty-nine males and eighty females from seventeen localities, all except one of which are in the State of California. These localities were Mesilla, New Mexico; San Diego, Coronado, San Bernardino, Cahon Pass, Los Angeles, Altadena, Mt. Wilson, Pasadena, Santa Barbara, Lancaster, Tehachapi, Kern City, Tulare, Monterey, Raymond and Ahwahnee, California. Rehn and Hebard in indicating single types of numerous Scudderian species restricted the name *pusilla* [13] to a single male from Mesilla, New Mexico, taken July 1, 1897, by A. P. Morse, formerly in the Scudder Collection and now in that of the Museum of Comparative Zoology. This individual we now know is representative of a valid subspecies of *Psoloessa texana,* and for which the name *Psoloessa texana pusilla* (Scudder) is current.

The material from the other sixteen localities clearly represents two other entities, one in fact belonging to a different genus. From the evidence of original material the Lancaster, Kern City and Raymond representations belong to *Eupnigodes sierranus* (Rehn and Hebard),[14] and those from Tehachapi, Ahwahnee and Tulare, which I have not seen, on the basis of other material from the same localities I would unhesitatingly refer to the same species. From representations of the original material it is seen that the lots from Los Angeles and Monterey belong to a species of *Psoloessa* here described as new, and from the basis of other material from the same localities and personal knowledge of the Orthoptera

[12] Proc. Amer. Acad. Arts and Sci., xxxv, p. 52, (1899).

[13] Proc. Acad. Nat. Sci. Phila., 1912, p. 92, (1912).

[14] *Ageneotettix sierranus* Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1909, p. 429, figs. 9 & 10. [♂, ♀; Summit House, Madera Co., California.] Material of this species now before me from the U. S. National Museum collection, taken at Atwater, California, by D. W. Coquillett, July 29, 1885, is doubtless the basis of that author's record of *Psoloessa texana* from the San Joaquin Valley (Rep. U. S. Entom., 1885, p. 297, (1886)). McNeill's record of *Stirapleura texana* from the same valley (Proc. Davenport Acad. Nat. Sci., VI, p. 271, (1897)) very probably was based on the Coquillett material. No true *Psoloessa* (or *Stirapleura*) is known from the floor of the San Joaquin Valley other than my present record of *P. thamnogaea* from its border at Coalinga.

of the area, it is evident that the San Diego, Coronado, San Bernardino, Cahon Pass, Altadena, Mt. Wilson, Pasadena and Santa Barbara individuals can similarly be referred. In consequence it is clear that Scudder's original series of *pusilla* represented two genera and three species, and that the name *pusilla* must be limited in accordance with the 1912 single type designation.

In other past literature the new Californian *Psoloessa* has been confused with the broadly distributed *P. texana,*[15] which, however, does not occur in California and fails to cross the apparent barrier of the Gila, Colorado and Mohave Deserts, although penetrating northwestward along the outer slope of the Colorado Plateau in Arizona.

The area of distribution of the new Californian *Psoloessa* is the same as that of a number of other forms representing the same faunal element, i.e. from the Monterey area southward, in the Coast Ranges and over most of southern California south and west of the Mohave and Colorado Deserts. It also occurs southward over Baja (Lower) California, Mexico.

Psoloessa thamnogaea[16] new species (Text-figs. 1–9.)

1897. *Psoloessa maculipennis* McNeill, Proc. Davenport Acad. Nat. Sci., VI, p. 273. (In part.) [Southern California only.]

1899. *Stirapleura pusilla* Scudder, Proc. Amer. Acad. of Arts and Sciences, XXXV, p. 52. (In part.) [Records from San Diego, Coronado, San Bernardino, Cahon Pass, Los Angeles, Altadena, Mt. Wilson, Pasadena, Santa Barbara and Monterey, California.]

1904. *Psoloessa maculipennis* Bruner, Biol. Cent.-Amer., Orth., II, p. 104. (In part.) [California only.]

1904. *Psoloessa texana* Bruner, Biol. Cent.-Amer., Orth., II, p. 104. (In part.) [California only.]

1905. *Psoloessa maculipennis* Baker, Invertebrata Pacifica, I, p. 75. [Claremont, California.]

1905. *Psoloessa ferruginea* Baker, Invertebrata Pacifica, I, p. 75. [Claremont, California.]

1910. *Psoloessa texana* Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1909, p. 428. (In part.) [Following records only; Tia Juana, Coronado Beach, Alamitos Bay, Miramar, Altadena, Pasadena and Echo Mountain, California.]

[15] Some of these records appear under the specific names *maculipennis* and *ferruginea,* which apply to what are apparently Mendelian color phases of *texana,* analogues of which also occur in *P. thamnogaea.*

[16] From θάμνος, *bush,* and γαῖα, *ground,* in allusion to its brushland habitat.

1923. *Psoloessa texana* Hebard, Proc. California Acad. Sci., (4) XII, p. 322. (In part.) [San Antonio, Lower California.]

1931. *Psoloessa* species Hebard, Trans. Amer. Entom. Soc., LVII, p. 118. [Ensenada, Hamilton's Ranch near Santo Domingo Mission and San Lucas, Lower California.]

When compared with material of the various subspecies of *Psoloessa texana* (i.e. *P. t. texana, P. t. pusilla* and *P. t. pawnee,* the latter here described) the present species is seen to differ consistently in the narrower head as seen in cephalic aspect (particularly in the female), in the more definitely ascending occiput, in the proportionate narrower eye outline as seen in profile, the slightly more retreating facial line, in the pronotum, as seen from the dorsum, being more markedly strangulate, with the lateral carinae of the disk quite definitely more inbowed mesad and their caudal (largely metazonal) sections more straight divergent, and in the less produced and blunter-angled subgenital plate of the male as seen in profile. In both sexes the fastigium averages definitely narrower than in the forms of *texana,* although in this feature the converging extremes of individual variation in *P. thamnogaea* and *P. texana pusilla* are less widely separated than the averages.

The present species is much closer to *P. texana pusilla* than it is to the other subspecies of *texana,* both of the latter being separable at once by their broader fastigia in addition to the features already given. The head width and pronotal form will, however, very readily distinguish the new species from *P. t. texana.*

Type.—♀; Murray Canyon above Mission Valley, San Diego County, California. Elevation 200 feet. August 19, 1937. (Rehn, Pate and Rehn.) [Academy of Natural Sciences of Philadelphia, Type no. 5661.]

Size medium (for the genus); general form slightly more compressed than in *P. texana.*

Head with occiput moderately ascending cephalad (more definitely so than in *P. texana*), width of interspace between eyes at vertex contained nearly twice in the transverse width of a single eye as seen from dorsum; fastigium narrow, quite definitely excavate, with the transverse arcuate limitation caudad as usual in genus, fastigial length to caudal point of its lateral margins slightly greater than its greatest width, which is subequal to the interspace between the eyes, cephalic margins slightly acute-angulate convergent meso-cephalad, lateral ones subparallel, caudad slightly converging to limit the fastigial disk, which is open in that direction, all margins sharp

and well elevated; lateral foveolae well marked, moderately impressed, in outline subfalcately narrowing cephalad, caudal margin straight; facial line moderately retreating and slightly arcuate ventrad, dorsad evenly curving over the fastigio-facial angle to the dorsal line of the fastigium: in cephalic aspect the width of the head across the genae is approximately equal to one and one-eighth times that across eyes (as 65 to 68), genae not notably inflated; frontal costa as usual in genus, evenly widening ventrad from fastigio-facial angle to median ocellus, obsolete ventrad of that point, nonsulcate but with medio-vertical portion of surface rather heavily impresso-punctate, lateral carinae marked. Eyes of the prominence usual in genus, in lateral aspect the basal eye outline is more elongate ovoid than in forms of *P. texana,* greatest eye width contained 1.6 times in the greatest eye depth, as against an average of 1.45 for the various races of *P. texana,* depth of the eye equal to 1.5 times the length of the infra-ocular sulcus. Antennae in length subequal to the combined dorsal length of head and pronotum, simple, weakly depressed, composed of 18 articles.

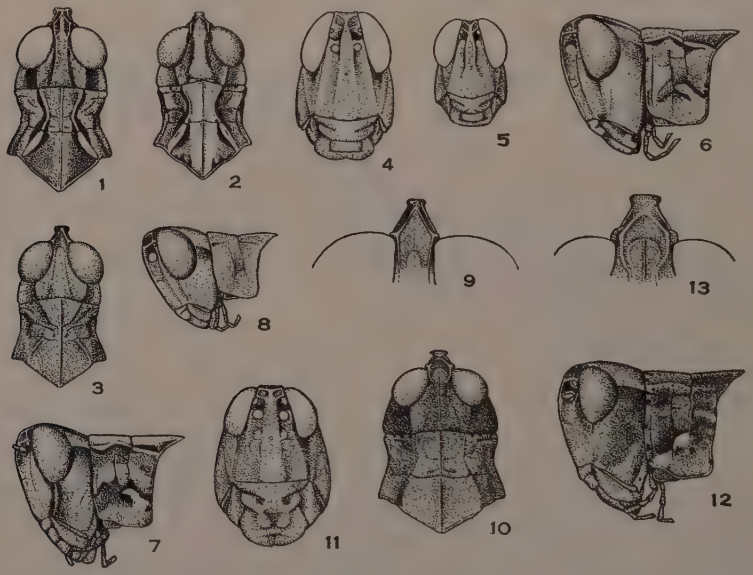
Pronotum appreciably but not strongly strangulate, greatest width caudad across ventral portion of lateral lobes equal to slightly more than mediodorsal length of pronotum, transverse width of the whole (not the dorsum alone) at the most constricted median point slightly less than greatest median length of disk; cephalic margin of disk subtruncate, caudal margin of same slightly more obtuse than a right angle; median carina of disk well elevated and sharply cut, narrow, lateral carinae heavier than median one, particularly caudad, with their convergence at cephalic third pronounced, more marked than in any of the forms of *P. texana,* their general form being almost subcruciate, the distance between the external sides of the carinae at cephalic margin of disk being slightly more than 1.5 times that between the same carinal surfaces at point of greatest approach, while at the caudal extremities of the carinae the distance between is 2.9 times that at least interspace, both the cephalic and caudal sections of the lateral carinae being almost straight oblique; principal transverse sulcus crossing disk slightly cephalad of its middle, narrowly intersecting median and lateral carinae, a more cephalic transverse sulcus on the prozona imperfectly intersecting the lateral carinae but not median one, this also being more sinuate than the principal one, disk area between the two sulci mesad with a pair of well impressed subsulcoid puncta: lateral lobes subquadrate, slightly deeper than dorsal length, cephalic and caudal margins subparallel, the former weakly sinuate, ventral margin nearly straight caudad, weakly oblique truncate cephalad, ventro-cephalic angle rounded obtuse, ventro-caudal angle rounded rectangulate; three subvertical sulci indicated, oblique cicatriform ridge indicated in caudal half from second sulci to caudal margin as in *P. texana,* this broadest dorso-cephalad, narrowing ventro-caudad, a weakly intimated slightly swollen area present intramarginally at the ventro-cephalic angle.

Tegmina surpassing the apices of caudal femora by approximately the length of metazona, form and character and venational depth as in *P. texana,*

except that the whole tegmen is slightly narrower proportionately than in any of the forms of *P. texana.* Wings fully developed.

Interspace between mesosternal lobes strongly transverse, its width equal to twice its median depth, medio-caudal angle of lobes broadly rounded, more so than in *P. texana;* interspace between metasternal lobes subquadrate, hardly more than a third that between mesosternal lobes.

Ovipositor jaws slightly shorter and thicker than in *P. texana,* particularly the dorsal valves, ventral valves with lateral plates shorter, blunter and less acute at apices. Distal margin of subgenital plate essentially as in *P. texana.*



Psoloessa thamnogaea new species. Female (*type*). Murray Canyon, San Diego Co., Cal. Fig. 1.—Dorsal view of head and pronotum (× 4). Fig. 4.—Cephalic view of head (× 4). Fig. 6.—Lateral view of head and pronotum (× 4). Male (*allotype*). Murray Canyon, San Diego Co., Cal. Fig. 3.—Dorsal view of head and pronotum (× 4½). Fig. 5.—Cephalic view of head (× 4). Fig. 8.—Lateral view of head and pronotum (× 4). Fig. 9.—Fastigium from dorsum (greatly enlarged). Female. Roscoe, Los Angeles Co., Cal. Fig. 2.—Dorsal view of head and pronotum (× 4). Fig. 7.—Lateral view of head and pronotum (× 4).

Psoloessa texana pawnee new subspecies. Female (*type*). Martin, South Dakota. Fig. 10.—Dorsal view of head and pronotum (× 4). Fig. 11.—Cephalic view of head (× 4). Fig. 12.—Lateral view of head and pronotum (× 4). Male (*allotype*). Martin, South Dakota. Fig. 13.—Fastigium from dorsum (greatly enlarged).

Cephalic and median limbs as slender as in *P. t. pusilla.* Caudal femora and tibiae as in the forms of *P. texana,* the external tibial spines 8 to 9, the internal 10 to 11 in the type. Internal calcaria strongly unequal in length.

Allotype.—♂; same data as type. [Academy of Natural Sciences of Philadelphia.]

Differing from the above description of the female type in the following noteworthy respects.

Size small (when compared with that of female); form slightly more slender proportionately than in female.

Head with width of interspace between eyes at vertex contained nearly 2.5 times in the transverse width of a single eye as seen from dorsum; fastigium with width proportionately less than in female, subequal to the interocular width, its surface much more deeply excavate than in the female, length of the fastigium, i.e. cephalic apex to caudal points of the lateral margins, equal to 1.5 times the greatest fastigial width, cephalic margins strongly acute-angulate convergent meso-cephalad, lateral margins very slightly diverging cephalad, their caudal sections becoming evanescent without converging about the excavate discal area; lateral foveolae as in female but slightly more longitudinal; in cephalic aspect the width of head across genae is subequal to that across eyes, genae hardly at all inflated; frontal costa as in female but somewhat narrower proportionately. Eye outline slightly narrower than in female, its greatest width contained 1.56 times in greatest eye depth, latter equal to twice the length of infra-ocular sulcus. Antennae equal in length to 1.1 times the combined length of head and pronotum.

Pronotum with general proportions as in female; cephalic margin of disk very weakly arcuate, caudal margin with its angular production almost as sharp as a right angle; cruciation of lateral carinae slightly more marked than in female, distance between external sides of the carinae at cephalic margin of disk nearly twice that between the same carinal surfaces at point of their closest approach, at caudal extremities of the carinae the distance between same is 2.75 times that at least interspace: lateral lobes more nearly quadrate than in female, the depth but very faintly greater than the dorsal length of lobe, ventral margin moderately arcuate caudad, oblique cicatriform ridge lower and less distinctly marked than in type female.

Tegmina reaching to the apices of caudal femora, general form and proportions as in female.

Metasternal lobes subcontiguous caudad.

Supra-anal plate elongate trigonal, apex acute, meso-proximal surface sharply sulcate. Cerci simple, styliform, evenly tapering, apically acute, straight. Subgenital plate short, subcompressed, briefly subconical dorso-caudad, apex relatively sharp even though short.

Limbs as in female. External caudal tibial margin with 9 to 10 spines, the internal 10 to 11.

Morphological Notes.—The table of measurements presented in the following table shows the extent of variation in tegminal length and that of the caudal femora encountered in this species. There is no direct correlation of the variation of these two parts, neither is there any grouping with either of these dimensions of similar fluctuations in the length of the pronotal disk. As in the other forms of this genus, and of a number of related genera as well, the disk of the pronotum in *thamnogaea* shows a range in proportions from a more attenuate type, which has less strongly sigmoid lateral carinae and a sharper caudal marginal angle, to a shorter and broader type, which has quite definitely sigmoid lateral carinae and a broader and less decided caudal marginal angle. The fastigium shows in its impressed area in both sexes a considerable plasticity in the ratio of breadth to length, although it is definitely narrower in all cases than in the related forms, only individuals with the broadest fastigia approaching the proportions seen in the narrowest fastigia found in *P. texana pusilla,* in which is the nearest approximation in this respect. As a whole the range in plasticity in structural features is in a corresponding ratio to that found in the other species of the genus, i.e. *P. texana* and *P. delicatula* and their respective subspecies.

Measurements (in millimeters)

♂	Length of body	Length of pronotum	Length of tegmen	Length of caudal femur
Del Monte, California	11.7	2.3	10.9	8
Del Monte, California	11.5	2.4	10.4	8.4
Paso Robles, California	12.7	2.2	11.6	9
Lompoc, California	13.7	3.4	13.2	9.3
Saugus, California	10.9	2.2	10.6	8.4
Saugus, California	12	2.5	11.4	8.4
Roscoe, California	11.2	2.2	10.7	8.6
Roscoe, California	12	2.6	11.4	9
Echo Mtn., California	11.2	3	10.7	8.1
Foothills, Claremont, California	11.9	3.1	11	8.8
Riverside, California	10.1	2.3	11.4	8.1
Banning, California	13.8	2.6	11.9	8.9
Murray Canyon, California, *allotype*	11.7	2.4	10.7	8.9
Tia Juana, California, *paratype*	12	3	11	8.1
Tia Juana, California, *paratype*	12.2	3.2	11.9	9
Hamilton's Ranch, Lower California	11.9	2.1	10.2	7.3
Catavina, Lower California	12.7	2.4	11.5	8.4
San Antonio, Lower California	11.7	2.4	12	8.4
San Antonio, Lower California	12.3	2.4	12.5	9.4

♀	Length of body	Length of pronotum	Length of tegmen	Length of caudal femur
Del Monte, California	16	3	12.8	9.5
Del Monte, California	16.9	3.4	14	11.6
Coalinga, California	16	3.6	15	11.5
San Miguel, California	18	3.7	16.8	12.5
Paso Robles, California	17.1	3.4	15.8	11.9
Paso Robles, California	18.4	3.6	16.3	12.2
Saugus, California	17	3.5	15.1	11.7
Roscoe, California	15.6	3.3	14.6	11.2
Roscoe, California	16.8	3.4	15.5	12
Echo Mtn., California	16.3	3.2	14.5	10.4
Foothills, Claremont, California	16.3	3.2	15	11.7
Riverside, California	17	3.1	15.3	11.5
Murray Canyon, California, *type*,	17.6	3.5	15.8	11.7
Tia Juana, California, *paratype*	17.2	3.6	14.8	11.4
Tia Juana, California, *paratype*	19.2	3.7	16.3	12.8
Ensenada, Lower California	17.6	2.9	13	9.7
Hamilton's Ranch, Lower California	17.7	3.2	14.8	11
Near San Antonio, Lower California	17.1	3.1	13.5	10.9
San Lucas, Lower California	19.3	3.2	13.5	10.6
San José del Cabo, Lower California	17.7	3	16.8	10.9

These measurements show the extent to which individual size variation is present over the range of the species, and also in series from a single locality from which the size extremes have been selected. It is clearly evident that the fluctuation in the exact length of the alar appendages is in no way correlated with a similar fluctuation in the length of the caudal femora, each of which varies without regard to the other dimension. While there appear to be some areal approximations in size range, these may be due to immediate optimum environmental conditions reflected in larger size, but there is no clear evidence of areal responses.

Color forms.—The color forms which are found in the related *P. texana* were discussed in detail by Rehn and Hebard over thirty years ago.[17] The conclusions then expressed as to the identity of these typically very different appearing forms, has been supported and strengthened by the accumulation of vastly more material and field observations during the intervening years, and it is equally evident, as was stated by the same authors, that Cali-

[17] Proc. Acad. Nat. Sci. Phila., 1908, p. 381, (1908): Idem, 1909, p. 144, (1909).

fornia material then referred to *P. texana,*[18] but now known to represent *thamnogaea,* exhibits exactly the same range of color forms. As was pointed out in 1908 the major portion of any series, representing as in now known either *texana* or *thamnogaea,* exhibits a broad range of intergradations, with typical material of the four main color types, on which distinctive names had been based,[19] constituting a minor part of the representation. Of available material of *thamnogaea* typical material of the *buddiana* color phase [20] consists of but eight specimens, representing both sexes and from the Los Angeles River (2), Altadena (3), Echo Mountain (1), Claremont (1) and Tia Juana (1). Typical material of the *ferruginea* color phase is seen from Del Monte (14), San Miguel (1), Paso Robles (2), Santa Cruz Island (1), Roscoe (7), Los Angeles (3), Los Angeles River (1), Pasadena (2), Altadena (4), Echo Mountain (5), Claremont (9), Miramar (6), Alamitos Bay (1), Riverside (2), Verdemont (1), Harvey's (1) and Elsinore (2). Typical material of the *maculipennis* color phase represents Del Monte (2), Paso Robles (1), Roscoe (2), Altadena (3), Echo Mountain (4), Claremont (3), San Pedro Hills (1), Anaheim (3), Corona (1), Riverside (2), Lake Hodges (1), Murray Canyon (2), Ocean Beach (2), Tia Juana (3) and Potrero (2). Typical material of the restricted color phase *texana* is before me from Monterey (1), Coalinga (1), Altadena (1), Echo Mountain (1), Riverside (1), Verdemont (1), Laguna Beach (1), Murray Canyon (2), Chulavista (1), Tia Juana (2) and Dulzura (1).

From these figures it will be seen that over half of the material of *P. thamnogaea* is typical of no one of the four color phases, but, as previously emphasized in connection with *P. texana,* represents shades in the intermingling of these apparently genetic or Mendelian entities within each of these species of the genus. But two localities (Altadena and Echo Mountain) are represented by what are considered typical individuals of all four phases. There is no geographic localization of any one of them, and also there is no definite environmental association.

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[18] Proc. Acad. Nat. Sci. Phila., 1909, p. 428, (1910).

[19] By type limitations all of these names, i.e. *texana, ferruginea* and *maculipennis* Scudder and *buddiana* Bruner, were based on material clearly referable to what we now call *P. texana texana* (Scudder).

[20] These phases were defined by Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1908, p. 382, (1908).

In addition to these four types there is present a tendency for wine or rose suffusion of much of the insect. This is very strongly marked in one male from Chulavista, although other individuals from the same place show no such suffusion. Other representatives from Paso Robles (1), Pasadena (1), Claremont (5), Elsinore, California (1) and Catavina, Lower California (1) show definite indications of this same wash, less deep or less general than in that from Chulavista. This may be correlated with ground color, as was definitely the case at Chulavista, although, as stated above, others from the same locality show no such response.

The type specimen of this species shows a mixture of the pattern elements of the *"ferruginea"* and the *"maculipennis"* phases, while the allotype approaches but is no means fully representative of phase *"texana."*

Paratypic Series.—The following individuals from a definite portion of the range of the species in San Diego County, California, have been selected as paratypes: Murray Canyon, 3 ♂, 3 ♀ (taken with the type and allotype) in the Academy collection; Coronado, 5 ♂, 4 ♀, Chulavista, 3 ♂, 2 ♀, Tia Juana, 4 ♂, 6 ♀, Jamacho, 3 ♂, 1 ♀, and Potrero, 1 ♂, 2 ♀, divided between the Academy and the Hebard Collection; Ocean Beach, 1 ♂, 1 ♀, Otay, 1 ♂, Campo, 1 ♀, and Dulzura, 2 ♀ in the Hebard Collection; Coronado, 1 ♂ in the Zoological Museum of the University of Michigan, and Palm City, 1 ♂ in the collection of the University of Kansas. The full data for these specimens is given in the tabulation of material of this species which has been examined.

Distribution.—This species is very definitely a member of the Californian coastal fauna within the limits of that state, failing to penetrate into the desert areas east of San Gorgonio Pass or north of Cajon Pass, in both cases, however, extending well up toward the upper part of the coastal side of these divides (Banning and Cajon Wash at Verdemont). Similarly while *thamnogaea* occurs at Campo and Potrero along the Lower Californian border, it does not reach the Colorado Desert to the eastward. Northward the species extends to at least the Monterey peninsula, but its distribution north of the Santa Barbara region is limited by the eastern boundaries of the Coast Ranges. It is known to penetrate into the San Joaquin Valley only at Coalinga, where apparently favorable

conditions have carried the vegetation of the hills about nearby Alcalde Canyon a short distance out upon the adjoining valley floor. In southern California *thamnogaea* apparently extends over the entire area east and north to the desert borders and below the Transition Life Zone on the higher mountains. In Lower California it is known at present to occur only in the northwestern San Diegan District and in the southern part of the Cape District, as defined by Nelson.[21] Material from these two Lower Californian areas is inseparable, although it is hardly probable that, at least to-day, this bush-loving species occurs in the very arid Vizcaino Desert Region which separates these two portions of Lower California.

Altitudinally this species ranges in California from sea-level to at least as high as 3700 feet (Harvey's on Mill Creek). It has been taken at a number of stations of 2000 to 2600 feet elevation (Echo Mountain, three miles northwest of Beaumont, Banning, Potrero and Campo), and seems to be limited in vertical distribution only by the absence of its required bush habitat.

Bionomics.—Dry ground surfaces in the neighborhood of patches or larger areas of short yellow sun-cured grasses are the preferred habitats of this distinctive species in California. These situations may be on flat land, rolling hills or steep slopes, and sometimes even in dry stream washes. Often the grass patches are scattered through stands of chamise (*Adenostoma fasciculatum*), which are so characteristic of more southern coastal California, sometimes even among manzanita (*Arctostaphylos*) or low acacia, and rarely, at higher elevations, among oaks. At some localities the stands of heavy chamise were breast-high, but *Psoloessa* was taken in the small grass patches found between the bushes in the more open parts of the cover. At Alamitos Bay and Miramar it was found on coastal dunes or immediately back of the same.

The species is as active as *Psoloessa texana,* springing rapidly into the air and taking flight. The coloration is usually quite definitely protective, and even in the strongly bicolored *buddiana* phase the pattern is obliterative and thus concealing.

The earliest date for which we have immature material is July 5 (La Jolla) and for adults July 24 (Coronado Beach). It is very

[21] "Lower California and Its Natural Resources." *Memoirs Nat. Acad. Sciences,* XVI, no. 1, (1921). See pages 117–121, pl. 31 for life areas.

probable that identifiable immature individuals may be encountered distinctly earlier in the season than July 5. The last date represented by immature specimens in the series before me is August 22 (Santa Barbara), when adults were also taken. A nearly continuous series of dates from August to early December is represented by the available California adults, with a single one taken as late as February 1 at Laguna Beach. In the northern section of its Californian range the first date represented by adult material is August 20 (San Miguel), while the first dates for adults or immature in the southern California area are those cited above for the species. In Lower California it has been taken adult as early as March 29–30 (ten miles below Todos Santos), March 31 (San Lucas) and April 3 (East base of Sierra de la Victoria), while it has been captured in that peninsula as late as November 14–17 (Hamilton's Ranch).

Northward the species probably disappears as adults earlier than southward, but we have no information on this point from the former area later than September 9–10 (Del Monte). I feel it clearly occurs at Del Monte much later than that date, but I doubt very much that it is present there through December and January, as it is in the more southern part of the state. It does not appear to be two-brooded in California, although we have immature individuals taken with adults as late as August 19 (Murray Canyon) and 22 (Santa Barbara). There is, however, a possibility it may be two-brooded in at least part of Lower California.

Material examined: 265; 120 ♂, 131 ♀, 3 juv. ♂, 11 juv. ♀.

CALIFORNIA: Monterey, Monterey Co.; 1 ♂; [A.N.S.P.].[22] Del Monte, Monterey Co.; IX, 9–10, 1910; (R. & H.); 13 ♂, 20 ♀; [A.N.S.P. and Hebard Cln.]. Arroyo Seco Ranch, Salinas Valley, Monterey Co.; VIII, 8, 1938; (Jean Russell); 3 ♂; [A.N.S.P.]. Coalinga, Fresno Co., 600–750 feet elev.; VIII, 30, 1922; (R. & H.); 1 ♀; [Hebard Cln.]. San Miguel, San Luis Obispo Co., 620 feet elev.; VIII, 11, 1937; (Rehn, Pate and Rehn); 1 ♀; [A.N.S.P.]. Paso Robles, San Luis Obispo Co., 750–1100 feet elev.; VIII, 21, 1909; (Hebard); 5 ♂, 6 ♀; [A.N.S.P. and Hebard Cln.]. Lompoc, Santa Barbara Co.; VIII, 6, 1938; (L. W. Hepner); 1 ♂; [A.N.S.P.]. Santa Barbara, Santa Barbara Co., sea-level to 200 feet elev.; VIII, 22, 1909; (Hebard); 1 ♀, 1 juv. ♂, 1 juv. ♀; [A.N.S.P. and Hebard Cln.]. Santa Cruz Island, Santa Barbara Co.; VII, 26–30, 1915; (C. H. Kennedy); 1 ♂,

[22] These are part of Scudder's original series of *Stirapleura pusilla,* bearing his characteristic labelling: "Stir. pusilla" (in his handwriting) and "Scudder's Type, 1899."

2 juv. ♂; [Hebard Cln. and Cornell Univ.]. Los Angeles County; VIII; 1♀; [A.N.S.P.]. Saugus, Los Angeles Co.; VIII, 22, 1909; (Rehn); 2♂, 1♀; [A.N.S.P. and Hebard Cln.]. Mint Canyon, Los Angeles Co.; VII, 31, 1935; (E. I. Beamer); 1♂; [Hebard Cln.]. Roscoe, Tujunga Wash, Los Angeles Co., 825 feet elev.; VIII, 23, 1909; (R. & H.); 5♂, 5♀; [A.N.S.P. and Hebard Cln.]. Verdugo, Verdugo Hills, Los Angeles Co., 750–900 feet elev.; VIII, 23, 1909; (R. & H.); 1♂, 2♀; [Hebard Cln.]. Los Angeles, Los Angeles Co.; VII, 21 and 25, 1897; (A. P. Morse); 1♂, 1♀; [A.N.S.P.]: [22] 1♀; [A.N.S.P.]: [22] (Coquillett); 1♂; [A.N.S.P.]. Los Angeles River, Los Angeles Co.; VIII, 1907; (O. C. Poling); 1♂, 3♀; [Hebard Cln.]. Pasadena, Los Angeles Co., 824 feet elev.; VIII, 1, 1907; (Hebard); 3♂; [Hebard Cln.]: (F. Grinnell, Jr.); 1♀; [A.N.S.P.]. Altadena, Los Angeles Co.; VIII, 8, 1907; (Hebard); 8♂, 10♀; [A.N.S.P. and Hebard Cln.]. Echo Mountain, San Gabriel Range, Los Angeles Co., 1700–2000 feet elev.; VIII, 8, 1907; (Hebard); 1♂; [Hebard Cln.]: IX, 18, 1910; (Rehn); 9♂, 10♀; [A.N.S.P. and Hebard Cln.]. Claremont, Los Angeles Co.; (C. F. Baker); 2♂, 3♀; [A.N.S.P. and Hebard Cln.]. Foothills at Claremont, Los Angeles Co.; VII, 25, 1915; (J. W. Rich); 9♂, 4♀; [A.N.S.P. and Hebard Cln.]. Mountains near Claremont, Los Angeles Co.; (C. F. Baker); 1♂; [Hebard Cln.]. Redondo Beach, Los Angeles Co.; VIII–IX, 1923; (Carl Brown); 2 juv. ♀; [Univ. Michigan]. San Pedro Hills, Los Angeles Co.; X, 5, 1922; (C. L. Hubbs); 1♀; [Univ. Michigan]. Miramar, Los Angeles Co.; VII, 31, 1907; (R. & H.); 5♂, 2♀, 3 juv. ♀; [A.N.S.P. and Hebard Cln.]. Alamitos Bay, Los Angeles Co.; VII, 31, 1907; (R. & H.); 1♀; [Hebard Cln.]. Anaheim, Orange Co.; (Coquillett); 2♂, 5♀; [A.N.S.P. and Hebard Cln.]. Corona, Riverside Co.; IX, 2, 1919; (R. & H.); 1♀; [Hebard Cln.]. Riverside, Riverside Co.; VII, 8, 1930 (juv.), VIII, 11 & 14, 1930, XI, 8, 10 & 14, 1933, XII, 6, 1929; (Timberlake); 3♂, 4♀, 1 juv. ♀; [Hebard Cln.]. Cajon Wash at Verdemont, San Bernardino Co., 1700 feet elev.; IX, 2, 1919; (R. & H.); 3♂; [A.N.S.P. and Hebard Cln.]. Harvey's, Mill Creek, San Bernardino Mts., San Bernardino Co., 3700 feet elev.; VIII, 30, 1919; (R. & H.); 2♂; [A.N.S.P. and Hebard Cln.]. Three miles N.W. of Beaumont, Riverside Co., 2540 feet elev.; VIII, 20, 1937; (Rehn, Pate and Rehn); 1♀; [A.N.S.P.]. Banning, Riverside Co., 2150 feet elev.; VIII, 20, 1937; (Rehn, Pate and Rehn); 3♂, 1 juv. ♀; [A.N.S.P.]. Laguna Beach, Orange Co.; II, 1, 1925; (O. C. Poling); 1♂; [Univ. Michigan]. Elsinore, Riverside Co., 1400 feet elev.; VIII, 19, 1937; (Rehn, Pate and Rehn); 1♂, 3♀; [A.N.S.P.]. Red Mountain near Fallbrook, San Diego Co., 1025 feet elev.; VIII, 19, 1937; (Rehn, Pate and Rehn); 1♀; [A.N.S.P.]. Lake Hodges near Escondido, San Diego Co., 400 feet elev.; VIII, 19, 1937; (Rehn, Pate and Rehn); 1♂, 1♀; [A.N.S.P.]. Warner Springs, San Diego Co.; VII, 28, 1938; (L. W. Hepner); 1♂; [A.N.S.P.].

Ramona, San Diego Co.; VIII, 10, 1914; (J. C. Bradley); 1♀; [Hebard Cln.]. Miramar, San Diego Co.; VII, 28, 1938; (L. W. Hepner); 1♂, 2♀; [Univ. of Kansas]. La Jolla, San Diego Co.; VII, 5, 1916; (G. P. Engelhardt); 1 juv. ♀; [Hebard Cln.]. Murray Canyon, above Mission Valley, San Diego Co., 200 feet elev.; VIII, 19, 1937; (Rehn, Pate and Rehn); 4♂, 4♀, 2 juv. ♀ (*type, allotype* and *paratypes* (adults only)); [A.N.S.P.]. Ocean Beach, San Diego Co.; IX, 26, 1922; (O. C. Poling); 1♂, 1♀ (*paratypes*); [Hebard Cln.]. Coronado, San Diego Co.; VII, 24, 1897; (A. P. Morse); 1♂ (*paratype*); [Univ. of Michigan]: (Blaisdell); 1♂, 2♀ (*paratypes*); [A.N.S.P. and Hebard Cln.]: VIII, 16, 1907; (Hebard); 4♂, 2♀ (*paratypes*); [A.N.S.P. and Hebard Cln.]. Chulavista, San Diego Co.; IX, 11, 1922; (R. & H.); 3♂, 2♀ (*paratypes*); [A.N.S.P. and Hebard Cln.]. Otay, San Diego Co.; VIII, 9, 1935; (R. H. Beamer); 1♂ (*paratype*); [Hebard Cln.]. Palm City, San Diego Co.; VII, 27, 1938; (Jean Russell); 1♂ (*paratype*); [Univ. of Kansas]. Tia Juana, San Diego Co.; VIII, 16, 1907; (Hebard); 1♂ (*paratype*); [Hebard Cln.]: IX, 11, 1922; (R. & H.); 3♂, 6♀ (*paratypes*); [A.N.S.P. and Hebard Cln.]. Jamacho, San Diego Co., 340 feet elev.; IX, 2, 1922; (R. & H.); 3♂, 1♀ (*paratypes*); [A.N.S.P. and Hebard Cln.]. Dulzura, San Diego Co., 1500 feet elev.; IX, 12, 1922; (R. & H.); 2♀ (*paratypes*); [Hebard Cln.]. Potrero, San Diego Co., 2323 feet elev.; IX, 12, 1922; (R. & H.); 1♂, 2♀ (*paratypes*); [A.N.S.P. and Hebard Cln.]. Campo, San Diego Co., 2400 feet elev.; IX, 13, 1922; (R. & H.); 1♀ (*paratype*); [Hebard Cln.].

Lower California, Mexico: Tijuana; VIII, 15, 1915; 1♂; [A.N.S.P.]. Ensenada; XI, 10–12, 1930; (Newbold & Morris); 4♀; [A.N.S.P. and Hebard Cln.]. Hamilton's Ranch; XI, 14–17, 1930; (Newbold & Morris); 1♂, 5♀; [A.N.S.P. and Hebard Cln.]. Catavina, between El Marmol and Chapala Dry Lake; VIII, 1941; (H. G. Richards); 1♂; [A.N.S.P.]. San Antonio; VII, 12–17, 1910; (J. B. Slevin); 1♂; [Hebard Cln.]: VII, 15, 1919; (J. F. Ferris); 2♂, 1♀; [Hebard Cln.]. East base of Sierra de la Victoria, near San Antonio; IV, 3, 1930; (Newbold & Morris); 1♀; [A.N.S.P.]. Ten miles below Todos Santos; III, 29–30, 1930; (Newbold & Morris); 1♀; [A.N.S.P.]. San Lucas; III, 31, 1930; (Newbold & Morris); 1♀; [A.N.S.P.]. San José del Cabo; 1♀; [Hebard Cln.].

III. A New Subspecies of Psoloessa texana

The form of *Psoloessa texana* inhabiting the more northern part of the range of the species in the Great Plains, is the least attenuate and relatively the broadest of the three subspecies into which *texana* can be divided. Previously undescribed, its distinctness has been known to me for many years, but its description was deferred until correlated studies were completed.

Psoloessa texana pawnee[23] new species (Text-figs. 10–13.)

1876. *Psoloessa maculipennis* Scudder, Ann. Rep. Chief of Engineers U. S. Army, 1876, Appen. JJ, p. 508. (Also Ann. Rep. U. S. Geol. Surv. W. of 100th Merid., 1876, p. 288, (1876).) (Not *P. maculipennis* Scudder, 1875.) [Southern Colorado.]

1883. *Psoloessa maculipennis* Bruner, Rep. U. S. Entom. Comm., III, p. 56. (In part.) [Colorado.]

1893. *Psoloessa ferruginea* Bruner, Publ. Nebr. Acad. Sci., III, p. 23. (Not *P. ferruginea* Scudder, 1875.) [Nebraska.]

1893. *Psoloessa maculipennis* Bruner, Publ. Nebr. Acad. Sci., III, p. 23. (Not *P. maculipennis* Scudder, 1875.) [Nebraska.]

1897. *Psoloessa maculipennis* Bruner, Ann. Rep. Nebr. State Board of Agric., 1896, p. 129. (Not *P. maculipennis* Scudder, 1875.) [Nebraska.]

1897. *Psoloessa ferruginea* Bruner, Ann. Rep. Nebr. State Board of Agric., 1896, p. 129. (Not *P. ferruginea* Scudder, 1875.) [Nebraska.]

1905. *Psoloessa maculipennis* Rehn, Trans. Kansas Acad. Sci., XIX, p. 222. (Not *P. maculipennis* Scudder, 1875.) [Clark County, Kansas.]

1906. *Psoloessa maculipennis* Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1906, p. 371. (Not *P. maculipennis* Scudder, 1875.) [Knob Hill, Colorado Springs, Colorado.]

1925. *Psoloessa texana* Hebard, Proc. Acad. Nat. Sci. Phila., LXXVII, p. 66 (exclusive of references). (Not *P. texana* Scudder, 1875.) [Martin and Pine Ridge, South Dakota.]

1929. *Psoloessa texana* Hebard, Proc. Acad. Nat. Sci. Phila., LXXXI, p. 332. (Not *P. texana* Scudder, 1875.) [Southern Colorado; Knob Hill, Colorado Springs, Colorado.]

1931. *Psoloessa texana* Hebard, Proc. Acad. Nat. Sci. Phila., LXXXIII, p. 144. (Not *P. texana* Scudder, 1875.) [Medora, Reno County; Garden City, Finney County; Barton, Clark, Sherman, Hamilton and Morton Counties, Kansas.]

1934. *Psoloessa texana* Hebard, Journ. Kansas Entom. Soc., VII, p. 28. (Not *P. texana* Scudder, 1875.) [Manhattan, Kansas.]

This more northern subspecies of *P. texana* can readily be distinguished from *P. t. texana,* its nearest relative, by the features given in the preceding key, i.e. the broader fastigium, which has its cephalic outline blunter in angulation, the more rounded fastigio-facial angle as seen in profile, the frontal costa averaging broader, in the lateral carinae of the dorsum of the pronotum cephalad averaging more nearly subparallel and less diverging, and in the caudal margin of the disk averaging more broadly obtuse-angulate

[23] As the Pawnees ranged over much of the territory where this subspecies is fully typical, this name is quite appropriate.

with the immediate angle less emphasized. When compared with *P. t. pusilla* the present form differs in essentially the same features as does *P. t. texana,* as set forth in the preceding key.

Type.—♀; Martin, Bennett County, South Dakota. June 24, 1924. (H. C. Severin.) [Hebard Collection, Type no. 1354.]

Size as usual in this species; form more robust than in *P. t. pusilla* and similar to that of *P. t. texana.*

Head broad (for the genus), eyes even less prominent than in *P. t. texana,* greatest breadth across genae, as seen in cephalic aspect, equal to one and one-third times that across eyes; fastigium as seen from dorsum relatively short and broad, the impressed area subequal in length and breadth, its general outline subcircular with cephalic border blunt obtuse-angulate, this broader, blunter and less pronounced than the angle of *P. t. texana,* lateral margins more appreciably converging caudad than in latter; fastigio-facial angle in profile more broadly and evenly rounded than in *P. t. texana,* the arcuation of the fastigial line more sweeping and in consequence, when compared with the condition found in *P. t. texana,* the lateral foveolae are more restricted as the broader arcuation of the outline has contracted their dorso-cephalic extent; frontal costa broad, evenly widening from the ventro-cephalic angle of lateral foveolae ventrad, weakly defined on lower face, breadth of costa between antennal bases subequal to three-fourths the inter-ocular width at vertex, surface of costa not sulcate but sparsely impresso-punctate with a limited area depressed about median ocellus: eyes less protuberant than in the other two forms of the species, in lateral aspect with basal outline shaped as in the other forms but less extensive dorso-ventrad, and in depth equal to but 1.25 times the length of infra-ocular sulcus. Antennae in length subequal to combined length of head and pronotum.

Pronotum relatively broad, the greatest width of disk caudad on metazona being but slightly less than the median length of pronotal disk, dorsal length of prozona but slightly less than that of metazona; cephalic margin of disk arcuato-truncate, caudal margin of disk broadly obtuse-angulate; median carina distinct, finer and narrower on metazona than on prozona; lateral carinae less sigmoid than average of related forms, on cephalic third nearly subparallel, but very faintly straight divergent cephalad, thence caudad moderately sigmoid diverging, the extreme caudal portion briefly subparallel, the whole of these carinae definitely but not sharply elevated on metazona, metazonal surface appreciably but not strongly impresso-punctate: lateral lobes definitely deeper than dorsal length, the latter being approximately equal to two-thirds the greatest depth of lobes, cephalic and caudal margins subparallel but weakly sinuate, particularly the caudal, ventral margin sinuately obtuse-angulate, ventro-cephalic angle rounded obtuse-angulate, caudal broadly rounded rectangulate, surface of lobes with a poorly defined brief and suboblique thickened area mesad, not reaching the margins and limited

longitudinally by the two subvertical impressed sulci, neither of which reaches the ventral margin.

Tegmina and wings briefly surpassing the apices of caudal femora, the difference being equal to no more than the dorsal length of pronotum, their general characteristics as in *P. t. texana.*

Interspace between mesosternal lobes definitely transverse, but slightly narrower than one of the lobes, the internal and caudo-internal margins of which are broadly arcuate; interspace between metasternal lobes subquadrate, slightly narrowed caudad. Ovipositor jaws and subgenital plate as in female of *P. t. texana.*

Limbs as in *P. t. texana.*

Allotype.—♂; same data as type. [Hebard Collection.]

Differing from the preceding description of female (type) sex in the following noteworthy features.

Size smaller and form proportionately somewhat less robust, as usual in male sex of this genus.

Head moderately broad, eyes slightly more prominent than in female, greatest width across genae, as seen in cephalic aspect, equal to 1.17 times that across eyes; fastigium as seen from dorsum broad for genus but narrower than in female, the impressed area approximately 1.25 times as long as its greatest breadth, its cephalic border definitely rectangulate, its lateral ones subparallel mesad and moderately short convergent caudad before again becoming subparallel and then disappearing, surface of impressed area definitely excavate with deepest portion transversely arcuate; fastigio-facial angle in general contour as in female but slightly less broadly rounded, and lateral foveolae in consequence slightly longer; frontal costa as in female except that briefly in the inter-antennal region the lateral margins are subparallel, and there is but the slightest surface depression about median ocellus; eyes slightly larger and more prominent than in female, in shape as in that sex, in depth equal to 1.6 times the length of infra-ocular sulcus. Antennae slightly longer than combined length of head and pronotum.

Pronotum relatively broad for sex, the greatest caudal width of metazonal disk contained nearly 1.25 times in the median length of disk; median carina of similar emphasis throughout; lateral carinae as in female; lateral lobes with ventral margin less definitely sinuate than in female, surface with oblique cicatricose area extended ventro-caudad to caudal margin, reaching same dorsad of ventro-caudal angle, dorsal margin of cicatricose area forming an obtuse angle at principal sulcus, which it crosses and interrupts.

Tegmina and wings surpassing the apices of caudal femora by a distance definitely less than the length of pronotal dorsum.

Interspace between metasternal lobes narrowly cordate, with lobes nearly contiguous caudad of the foramina.

Morphological Notes.—General size variation is illustrated in the succeeding table of measurements, but the same will show an appreciable amount of individual variation in the length of the tegmina (and wings) and that of the caudal femora, this relatively independent of body or pronotal length. The relative proportions of the impressed area of the fastigia vary very definitely from as much as 1.18 to 1.33 in breadth contained in length in males (North Platte) and from subequal to 1.1 in females (former type, latter from North Platte). The ratio of breadth across the metazonal portion of the pronotal disk to the median length of the whole pronotum varies from the former contained in latter but 1.1 to as much as 1.35. Similarly the exact degree of sigmoidal flexure of the lateral carinae of the pronotum caudad varies very appreciably, occasionally these lacking any sigmoid tendency at all, being subregularly straight divergent caudad. The exact degree of the obtuse angulation of the caudal margin of the pronotal disk also varies individually, in series of the same sex from the same locality. The lateral lobes of the pronotum similarly show an appreciable range in relative breadth to depth, ranging from the one extreme described for the female type to an opposite one in which the depth and breadth are virtually subequal. The extent and emphasis of the oblique cicatricose area on the lateral lobes of the pronotum varies greatly, from one in which this is no more marked than as described for the type, to an opposite condition in which the area is as extensive and evident as noted under the allotype, while occasionally there is either no indication at all, or but the very faintest one of this feature, which was supposed at one time to be of outstanding, even generic, differential value. This range of emphasis of the lateral cicatricose rugae may be noted in material of the same sex in the same series, and has no sexual or geographic correlation, in this respect fully agreeing with what is found in *P. delicatula delicatula,* as noted elsewhere in this study. In numerous specimens, some even from the type locality, the tegmina are so short they exceed the apices of the caudal femora by no more than half the pronotal length. It is quite evident that plasticity in certain morphological details is quite as evident in this subspecies as in the others of *P. texana.*

Measurements (in millimeters)

	Length of body	Length of pronotum	Length of tegmen	Length of caudal femur
Typical *P. t. pawnee*				
♂, Martin, South Dakota, *allotype*..	14.6	3	13	10.2
♂, Martin, South Dakota, *paratype*..	14.3	2.9	13	10.4
♂, Holt Co., Nebraska, *paratype*....	15	2.6	12.5	9.6
♂, North Platte, Nebraska, *paratype*.	14.8	2.7	12.2	9.2
♂, North Platte, Nebraska, *paratype*.	15.6	3	13.5	10.2
♂, Sterling, Colorado, *paratype*.....	13.3	2.7	12.8	10.1
♂, Sterling, Colorado, *paratype*.....	14.8	2.7	13.8	9.9
♂, Fisher's Peak, Colorado.....	14.1	2.6	12.5	11.2
♂, Medora, Kansas.....	16.4	2.9	14.1	10.2
♀, Martin, South Dakota, *paratype*..	20.5	3.4	15.5	11.5
♀, Martin, South Dakota, *type*.....	21.3	3.4	17.9	12
♀, Holt Co., Nebraska, *paratype*....	20.8	3.6	16.1	11.5
♀, Holt Co., Nebraska, *paratype*....	22.8	3.7	16.9	12.5
♀, Brady Island, Nebraska, *paratype*	21.2	3.5	16.1	12
♀, Brady Island, Nebraska, *paratype*	22.8	3.9	19	12.7
♀, Sterling, Colorado, *paratype*.....	20.3	3.4	16.8	11.9
♀, Sterling, Colorado, *paratype*.....	21	3.5	16	11.7
♀, Colorado Springs, Colorado.....	17.4	3	14+	11.7
♀, Colorado Springs, Colorado.....	21	3.5	16.1	12
♀, Manhattan, Kansas.....	20	3.9	16.6	13
Atypical *P. t. pawnee*				
♂, Trinidad, Colorado.....	12.5	2.2	11.2	7.9
♂, Trinidad, Colorado.....	13.5	2.6	12.2	9.6
♂, Clark Co., Kansas.....	17	3	13.8	10.6
♀, Trinidad, Colorado.....	20.8	3.4	16.3+	11.4
♀, Clark Co., Kansas.....	22.8	3.9	17.1	13.6
♀, Clark Co., Kansas.....	24.4	3.6	19+	14.5
♀, Kenton, Oklahoma.....	22.8	3.9	18+	13
♀, Ripley, Oklahoma.....	22.8	4	16.9	12.2
♀, Hereford, Texas.....	21.5	3.5	18.4	13.5
♀, Hereford, Texas.....	21.6	3.7	18.4	13

The above measurements, in a number of cases of extremes in series, give a clear picture of the individual size variation found in this form. It is evident there is little areal correlation of size within the range of typical *P. t. pawnee,* but there is a definite size increase as we reach the area of atypical representation in Kansas and Oklahoma, where conditions seem to be more favorable for optimum development of this species.

Color Notes.—In this subspecies the four marked color types which are so well developed in both *P. t. texana* and *P. t. pusilla* are much less clearly evident. By far the greater part of the series of *P. t. pawnee* examined is representative of no one color phase, but instead of definite blendings of one or more. I have seen no full development of the *"buddiana"* phase in typical *P. t. pawnee* except in one female from Colorado Springs, Colorado, although one atypical female from Trinidad, Colorado and another from Clark Co., Kansas, as well as a female from Tesuque Creek, New Mexico, intermediate between *P. t. pawnee* and *P. t. pusilla,* are in the *"buddiana"* phase. The *"maculipennis"* phase is seen in individuals from Martin, South Dakota; North Platte, Holt County and Brady Island, Nebraska, and Sterling, Colorado. The *"ferruginea"* phase is represented by material from Martin, South Dakota; Halsey, Nebraska, and Sterling and Austin Bluffs, Colorado, while the *"texana"* phase is clearly marked only in atypical material from Kenton and Ripley, Oklahoma. The area of the oblique callosity on the lateral lobes of the pronotum may or may not be contrastingly creamy white, although when it is structurally developed the area is generally contrastingly colored. Occasionally the dorsum of the pronotum, more rarely the occiput, and the tegmina are washed with purplish rufescent, again they may be quite broadly clouded with fuscous but with much pale pronotal pattern also retained, and finally from the higher Great Plains numerous specimens are overtinted with dull silvery gray, or very rarely greenish yellow (Sterling). A few of each sex show a pattern reminiscent of *Orphulella,* i.e. with paired small triangles of fuscous laterad on the mesonotal disk, and a single female from Brady Island has the pronotal disk largely pale with mesad a transverse, broken but symmetrical, fuscous blotch.

Paratypic Series.—I have indicated as paratypes the following material: 3 ♂ and 6 ♀ from Martin, South Dakota, in the Hebard Collection and those of the Academy and the Zoological Museum of the University of Michigan; 1 ♂ from Pine Ridge, South Dakota, in the Hebard Collection; 1 ♀ from Julesburg, Colorado, in the Hebard Collection; 3 ♂, 3 ♀ from Sterling, Colorado, in the Academy series and the Hebard Collection; 1 ♂, 9 ♀ from Holt County, Nebraska, in the same two series; 2 ♂, 2 ♀ from "Sand Hills," Nebraska, in the Academy collection; 4 ♀ from Halsey,

Nebraska, in the Hebard and Academy collections, and 5 ♂, 1 ♀ from North Platte, and 5 ♀ from Brady Island, Nebraska, in the same two series.

Distribution.—This most northern of the three subspecies into which *P. texana* divides is, in its typical condition, an inhabitant of the High Plains, southward becoming unstable and passing into *P. t. texana* as Texas is approached, and intergrading similarly, toward the southwest in parts of northern New Mexico into *P. t. pusilla.* Northward it reaches to the Pine Ridge country of southern South Dakota (Pine Ridge and Martin), thence southward across western and much of central Nebraska and Colorado east of the Rocky Mountains, remaining typical as far southward as central (Medora) and east-central (Manhattan) Kansas. In western and southwestern Kansas, as well as at the north foot of the Raton Mesa in central southern Colorado (Trinidad), in parts of the Panhandle of Oklahoma (Kenton and eight miles southeast of Guymon) and the north-central part of the same state along the Cimarron River (Ripley) and even to the northern Staked Plains of Texas (four miles south of Hereford) it is atypical, showing the beginnings of intergradation into *P. t. texana.* From areas along the North Canadian Rim Valley in extreme western Oklahoma and in the south-central part of that state the representation is intermediate between *P. t. texana* and *P. t. pawnee,* while a female from Brownfield, Terry County, Texas, which by its intermediate features definitely ties together *P. t. texana, P. t. pusilla* and *P. t. pawnee,* indicates a common meeting point of these forms.

The persistence of typical *P. t. pawnee* at higher elevations in an area where at lower levels atypical individuals of that subspecies occur, is evidenced by a typical male from 7000–8000 feet on Fisher's Peak on Raton Mesa, southern Colorado, immediately at the northern foot of which uplift at 6100–6700 feet (Trinidad) the representation is atypical. The most eastern points from which I have seen typical *P. t. pawnee* south of the two northern extreme points are Holt County, Nebraska and Manhattan, Kansas, while from Oklahoma no identifiable adult material has been seen from east of Payne County (Ripley) and the Wichita National Forest in Comanche County. No material of *P. t. pawnee* has been seen from Wyoming, but doubtless it occurs over at least the lower levels of the southeastern plains of that state, and may there reach its northwestern extreme of distribution.

The passing of *P. t. pawnee* into *P. t. pusilla* in northern and northeastern New Mexico is attested by clearly intermediate material from Koehler Junction, Las Vegas, the vicinities of Tesuque Pueblo and Frijoles Canyon, Jemez Springs and the Tijeras section east of Albuquerque.

Altitudinally *P. texana pawnee* in its typical condition ranges from as low as 1000 feet at the eastern edge of its distribution (Manhattan, Kansas), to as high as 7000–8000 feet (Fisher's Peak, Colorado), and intermediates between it and *P. t. pusilla* are known from elevations up to the same maximum (8000 feet—Mesa 2 miles north of Frijoles Canyon, New Mexico). Presumably its passage into *P. t. texana* takes place over territory not distinctly different altitudinally from that inhabited by typical or atypical *P. t. pawnee,* but available data are not extensive enough to warrant a definite assertion on this point.

Biological Notes.—This form is quite local in occurrence, preferring scantily covered sand-hill areas or short grass stretches of the Great Plains within its range, these habitats sometimes with a little sage and low yuccas (Julesburg, Colorado). Occasionally (Trinidad, Colorado) it was found under open stands of juniper and pinyon on mesa benches, where sufficient sunlight enabled short grass to infiltrate between the trees. It is quite partial to sand-hills, sometimes there definitely in small colonies (North Platte, Nebraska), and occasionally is seen only in "blow-outs" of pure sand. On Fisher's Peak, Colorado, at the highest point where I personnally collected it, the habitat was slopes with open cover of short grass and rabbit-weed (composites) immediately below Canadian Zone conditions.

The earliest date I have for adults of *P. t. pawnee* is April 11, when it was taken at Manhattan, Kansas, and the latest August 17, when my colleague Mr. Hebard secured it at Knob Hill, near Colorado Springs, Colorado.

The localization of this more northern form of *P. texana,* and its apparent infrequence even at the preferred localities, would seem to indicate that the species *Psoloessa texana* is much less adapted to the more northern areas inhabited by the genus than is *Psoloessa delicatula,* which latter ranges much to the northward of *texana,* and is more broadly and generally distributed over much of the area in which typical *P. texana pawnee* occurs.

Specimens examined: 128; 47 ♂, 81 ♀.

Typical *Psoloessa texana pawnee*

South Dakota: Martin, Bennett Co.; VI, 16, 1925; (H. C. Severin); 2 ♂, 2 ♀ (*paratypes*); [Univ. of Mich. and A.N.S.P.]: VI, 24, 1924; (H. C. Severin); 2 ♂ (1 *allotype*), 5 ♀ (*type* and *paratypes*); [Hebard Cln. and A.N.S.P.]. Pine Ridge, Shannon Co.; VI, 25, 1924; (H. C. Severin); 1 ♂ (*paratype*); [Hebard Cln.].

Colorado: Julesburg, Sedgwick Co., 3460–3550 feet; VII, 29, 1910; (R. & H.); 1 ♀ (*paratype*); [Hebard Cln.]. Sterling, Logan Co., 4100 feet; VII, 15, 1909; (R.); 3 ♂, 3 ♀ (*paratypes*); [Hebard Cln. and A.N.S.P.]. Colorado Springs, El Paso Co.; 1 ♀; [Hebard Cln.]: 6000 feet; 1915; (H. B. Baker); 1 ♀; [Hebard Cln.]. Knob Hill, Colorado Springs, El Paso Co.; VIII, 17, 1904; (H.); 1 ♀; [Hebard Cln.]. Austin Bluffs, Colorado Springs, El Paso Co., 6300 feet; VI, 9 and 30, 1914, 1916; (H. B. Baker); 3 ♀; [Hebard Cln.]. Fisher's Peak, Raton Mesa, Las Animas Co., 7000–8000 feet; VII, 24, 1919; (R. & H.); 1 ♂; [Hebard Cln.].

Nebraska: Holt Co.; V; 1 ♂, 9 ♀ (*paratypes*); [A.N.S.P. and Hebard Cln.]. Sand Hills; 2 ♂, 2 ♀ (*paratypes*); [A.N.S.P.]. Halsey, Thomas Co.; VII, 11, 1909; (R.); 3 ♀ (*paratypes*); [Hebard Cln. and A.N.S.P.]: 1 ♀ (*paratype*); [A.N.S.P.]. North Platte, Lincoln Co., 2850 feet; VII, 28, 1910; (R. & H.); 5 ♂, 1 ♀ (*paratypes*); [Hebard Cln. and A.N.S.P.]. Brady Island, Lincoln Co.; V (part); 5 ♀ (*paratypes*); [Hebard Cln. and A.N.S.P.].

Kansas: Manhattan, Riley Co.; IV, 11, 1932; (R. H. Painter); 1 ♀; [A.N.S.P.]. Mendora, Reno Co.; VI, 25, 1923; (R. H. Beamer); 2 ♂; [Hebard Cln.].

Atypical *Psoloessa texana pawnee*

Colorado: Trinidad, Las Animas Co.; VII, 23–25, 1919; (R. & H.); 3 ♂, 1 ♀; [A.N.S.P. and Hebard Cln.].

Kansas: Sherman Co.; VIII, 1, 1925; (R. H. Beamer); 1 ♂; [Hebard Cln.]. Barton Co., 1816 feet; VI, 28, 1912; (F. X. Williams); 1 ♀; [Hebard Cln.]. Hamilton Co., 3350 feet; (F. H. Snow); 2 ♀; [Hebard Cln.]. Garden City, Finney Co., VI, 1895; (H. W. Menke); 3 ♀; [Univ. of Kansas and A.N.S.P.]. Morton Co., 3200 feet; VI; (F. H. Snow); 1 ♀; [Univ. of Kansas]. Clark Co., 1962 feet; VI, (F. H. Snow); 2 ♂, 4 ♀; [A.N.S.P. and Hebard Cln.].

Oklahoma: Kenton, Cimarron Co.; VII, 6, 1926; (T. H. Hubbell); 1 ♀; [A.N.S.P.]. Eight miles southeast of Guymon, Texas Co.; VI, 27, 1926; (T. H. Hubbell); 1 ♀; [Univ. of Mich.]. Ripley, Payne Co.; IV, 15, 1925; 1 ♀; [A.N.S.P.].

Texas: Four miles south of Hereford, Deaf Smith Co.; VI, 7, 1925; (C. H. Gable); 2 ♀; [Hebard Cln.].

Intermediates between *Psoloessa texana texana* and *P. t. pawnee*

Oklahoma: Boise City, Cimarron Co.; VI, 30, 1926; (T. H. Hubbell); 4♂, 2♀; [Univ. of Mich. and A.N.S.P.]. Sandy dunes and flats of the North Canadian River, south of Boise City, Cimarron Co.; VI, 30, 1926; (T. H. Hubbell); 1♂, 2♀; [A.N.S.P. and Hebard Cln.]. Cimarron Co.; VI, 30, 1926; (T. H. Hubbell); 2♂; [Hebard Cln.]. Wichita National Forest, Comanche Co.; VI, 7–8, 1926; (T. H. Hubbell); 2♀; [Univ. of Mich. and A.N.S.P.].

Intermediates between *Psoloessa texana pawnee* and *P. t. pusilla*

New Mexico: Koehler Junction, Colfax Co.; VII, 21, 1926; 1♀; [Hebard Cln.]. Las Vegas, San Miguel Co.; VII, 18, 1936; (J. D. Beamer); 1♂; [Hebard Cln.]. Tesuque Creek, Santa Fé Co., 7000 feet; VII, 28, 1919; (R. & H.); 5♂, 7♀; [Hebard Cln. and A.N.S.P.]. Three miles northeast of Tesuque Pueblo, Santa Fé Co., 7200 feet; VII, 19, 1934; (H.); 2♂, 2♀; [Hebard Cln.]. Mesa 2 miles north of Frijoles Canyon, Sandoval Co.; VIII, 2, 1934; (H.); 1♀; [Hebard Cln.]. Jemez Springs, Sandoval Co., 6400 feet; V, 17—VIII, 8, 1913; (John Woodgate); 4♂, 6♀; [Hebard Cln.]. Tijeras, Sandia Mountains, Bernalillo Co., 6500 feet; VII, 29, 1919; (R. & H.); 2♂, 1♀; [Hebard Cln. and A.N.S.P.]. Tijeras Canyon, Sandia Mountains, Bernalillo Co., 6300 feet; VII, 29, 1919; (R. & H.); 1♂; [Hebard Cln.].

Intermediate between *Psoloessa texana texana, P. t. pusilla* and *P. t. pawnee*

Texas: Brownfield, Terry Co.; V, 10, 1931; (S. E. Jones); 1♀; [Hebard Cln.].

IV. Forms of the Genus Psoloessa occurring in the United States

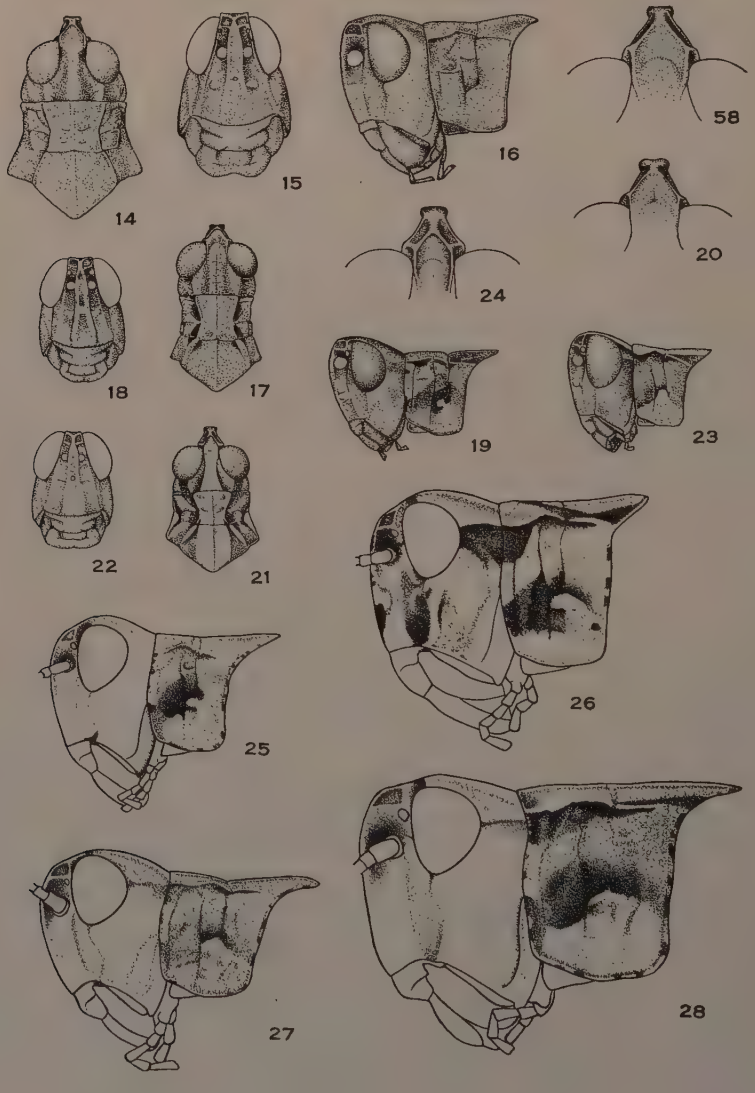
The synonymy here presented has been established in previously issued publications, or is here first proposed. The original material on which these names were erected is discussed and analyzed as far as the same is in existence or has been available. The distributions have been worked out in detail from series representing some hundreds of localities. No attempt has been made to record all of the latter, although peripheral or specially noteworthy ones are given in detail. The references to figures are to facilitate the use of the accompanying illustrations. The sequence of forms is that felt to be most natural and expressing relationships.

Psoloëssa thamnogaea new species (Text-figs. 1–9.)

For the description and full discussion of this species see the first portion of the present paper (page 175).

Psoloessa texana Scudder

Composed of three subspecies, here treated individually. The distribution of the species as a whole is the aggregate of those which are here treated seriatim.



Psoloessa texana texana Scudder (Text-figs. 14–20 and 58.)

1875. *Psoloessa texana* Scudder, Proc. Boston Soc. Nat. Hist., XVII, p. 512. [♂, ♀; Dallas, Texas.]

1875. *Psoloessa ferruginea* Scudder, Proc. Boston Soc. Nat. Hist., XVII, p. 513. [♂, ♀; Dallas, Texas.]

1875. *Psoloessa maculipennis* Scudder, Proc. Boston Soc. Nat. Hist., XVII, p. 513. [♀; Dallas, Texas.]

1890. *Psoloessa buddiana* Bruner, Proc. U. S. Nat. Mus., XII, p. 61, pl. 1, fig. 6. [♀; Carrizo Springs, Southern Texas.]

Type.—♀; Dallas, Texas. March 24. (Boll.) [Museum of Comparative Zoology, ex Scudder Collection.] Lectotype here selected.

Original material.—The original material of *P. texana* consisted of two males and a female, taken at Dallas by Boll, March 24 and June 6. The Museum of Comparative Zoology series now contains one male and the single female of this series, which are specifically labelled in Scudder's handwriting, together with the printed Dallas label with "Boll's No." used on most of that collector's series, as well as printed labels reading "Scudder's Type 1875." The male was taken June 6, and the female, here selected as the lectotype, March 24. Scudder's *P. ferruginea* was based on one male and three females from the same series as the type lot of *P. texana,* being taken March 24 and April 25 and 29. Of these two,

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Psoloessa texana texana Scudder. Female (*paratype*). Dallas, Texas. Fig. 14.—Dorsal view of head and pronotum (× 4). Fig. 15.—Cephalic view of head (× 4). Fig. 16.—Lateral view of head and pronotum (× 4). Fig. 58.—Fastigium from dorsum (greatly enlarged). Male (*topotype*). Dallas, Texas. Fig. 17.—Dorsal view of head and pronotum (× 4). Fig. 18.—Cephalic view of head (× 4). Fig. 19.—Lateral view of head and pronotum (× 4). Fig. 20.—Fastigium from dorsum (greatly enlarged).

Psoloessa texana pusilla (Scudder). Male. Aden, New Mexico. Fig. 21.—Dorsal view of head and pronotum (× 4). Fig. 22.—Cephalic view of head (× 4). Fig. 23.—Lateral view of head and pronotum (× 4). Female. El Paso, Texas. Fig. 24.—Fastigium from dorsum (greatly enlarged).

Psoloessa delicatula delicatula (Scudder). Male. Trinidad, Colorado. Fig. 25.—Lateral view of head and pronotum (× 6). Female. Trinidad, Colorado. Fig. 26.—Lateral view of head and pronotum (× 6).

Psoloessa delicatula buckelli Rehn. Male (*type*). Oliver, British Columbia. Fig. 27.—Lateral view of head and pronotum (× 6). Female (*allotype*). Oliver, British Columbia. Fig. 28.—Lateral view of head and pronotum (× 6).

both females, triply labelled in the same fashion as those of *texana,* have been studied in the collections of the same institution. Of the two original females of *P. maculipennis,* which also formed part of the same general series (i.e. Dallas—Boll), and were taken March 23, one female bearing a triple series of labels of the same character as those of *texana* and *ferruginea,* has been studied in the series at the Museum of Comparative Zoology. Bruner's *P. buddiana* was founded on two females, the subsequently selected lectotype,[24] now in the Hebard Collection, being before me.

Synonymy.—The synonymy of *Psoloessa ferruginea, maculipennis* and *buddiana* under *P. texana* was established in 1908 by Rehn and Hebard,[25] these names representing color phases of the same species, and incidentally the same subspecies. The validity of these associations has been confirmed by the greatly augmented series, now containing over a thousand specimens of the various subspecies of *texana,* which are before me.

Distribution.—The eastern limits of the distribution of *P. t. texana,* on the basis of present information, would be indicated in Texas by a line drawn from Dallas, Dallas County, through College Station, Brazos County,[26] to Sarita, Kenedy County,[27] continuing southward through Katherine, Willacy County [28] and Lyford, Cameron County,[29] to the Rio Grande. The western limits of typical and atypical *P. t. texana* in Texas are roughly indicated by a line connecting North Ranch in Palo Pinto County,[30] Comanche County,[31] Kerrville, Kerr County,[32] Uvalde, Uvalde County,[33] Carrizo Springs, Dimmit County and Laredo, Webb County.[34] Material from Laredo and Carrizo Springs, as well as from Cotulla, Lasalle County,[35] some distance to the eastward, varies from

[24] See Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1912, p. 63, (1912).
[25] Proc. Acad. Nat. Sci. Phila., 1908, p. 381.
[26] XII, 27, 1905; 2 juv. ♂; [A.N.S.P. and Hebard Cln.].
[27] XI, 30, 1911; 1 ♂; [Hebard Cln.].
[28] VIII, 8, 1912; (R. & H.); 2 ♂, 8 ♀; [A.N.S.P. and Hebard Cln.].
[29] VIII, 6–7, 1912; (H.); 5 ♂, 7 ♀; [A.N.S.P. and Hebard Cln.].
[30] VII, 31—VIII, 2, 1934; (F. B. Isely); 1 ♂; [A.N.S.P.].
[31] VI, 6, 1928; (H. B. Parks); 1 ♂, 2 ♀; [A.N.S.P. and Hebard Cln.].
[32] 1525–1800 feet; VIII, 17–18, 1912; (R. & H.); 2 ♀; [Hebard Cln.].
[33] 1000–1100 feet; VIII, 21–22, 1912; (R. & H.); 1 ♂, 3 ♀; [Hebard Cln. and A.N.S.P.].
[34] 500–550 feet; VIII, 10–12, 1912; (R. & H.); 6 ♂, 9 ♀, 1 juv. ♀; [Hebard Cln. and A.N.S.P.].
[35] 450 feet; VIII, 13–14, 1912; (R. & H.); 2 ♂, 1 ♀; [Hebard Cln.].

typical to a definitely atypical condition. The intergradation of *P. t. texana* and *P. t. pusilla* in Texas takes place between the extreme western limit given above for *P. t. texana,* and the eastern one of atypical *P. t. pusilla* in the more elevated portions of trans-Pecos Texas, as discussed under the distribution of the latter subspecies.

Northward the passing of *P. texana texana* into the typically more northern Great Plains *P. t. pawnee* becomes apparent in the southern and the Panhandle sections of Oklahoma, the influence of *P. t. texana* apparently following up river valleys into areas which on the higher levels of the adjacent plains are inhabited by atypical *P. t. pawnee.* Material intermediate between *P. t. texana* and *P. t. pawnee* has been examined from Boise City,[36] from sandy flats of the North Canadian River south of Boise City, Cimarron County,[37] Oklahoma, and from the Wichita National Forest in Comanche County [38] of the same state. A single specimen from Brownfield, Terry County,[39] Texas shows a definite blending of *P. t. texana, P. t. pusilla* and *P. t. pawnee,* and would indicate the approximate meeting place of all three of these subspecies.

In Mexico typical *P. t. texana* is known to extend south only to southern Tamaulipas (between Villa Juarez and thirty-five miles south of same [40]) and west to the northwestern part of the same state (twelve miles south of Nuevo Laredo [41]) and western Nuevo Leon (fifteen miles west of Monterrey [42]). Atypically it is indicated westward as far as northern Nuevo Leon (Mamulique Pass [43]), southeastern Coahuila (Higueros, between Monterrey and Saltillo [44]), east-central San Luis Potosi (sixty to seventy-five kilometers east of San Luis Potosi [45]) and western Hidalgo (Tula River, Tasquillo [46]).

[36] VI, 30, 1926; (T. H. Hubbell); 4 ♂, 2 ♀; [Univ. of Mich. and A.N.S.P.].
[37] VI, 30, 1926; (T. H. Hubbell); 1 ♂, 2 ♀; [A.N.S.P. and Hebard Cln.].
[38] VI, 7–8, 1926; (T. H. Hubbell); 2 ♀; [Univ. of Mich.].
[39] V, 10, 1931; (S. E. Jones); 1 ♀; [Hebard Cln.].
[40] 400–1000 feet; VII, 25, 1936; (H. Radclyffe Roberts); 2 ♀; [A.N.S.P.].
[41] 400 feet; VII, 9, 1936; (H. Radclyffe Roberts); 5 ♂, 5 ♀; [A.N.S.P.].
[42] 3000 feet; VII, 16, 1936; (H. Radclyffe Roberts); 2 ♂, 7 ♀; [A.N.S.P.].
[43] 1800 feet; VII, 11, 1936; (H. Radclyffe Roberts); 2 ♂; [A.N.S.P.].
[44] 4000 feet; IX, 14, 1936; (H. Radclyffe Roberts); 1 ♂, 2 ♀; [A.N.S.P.].
[45] 5000–6000 feet; IX, 6, 1940; (H. Radclyffe Roberts); 5 ♀; [A.N.S.P.].
[46] 5500 feet; IX, 9, 1936; (H. Radclyffe Roberts); 4 ♀; [A.N.S.P.].

Intermediates between *P. t. texana* and *P. t. pusilla* from Mexico have been examined from a number of areas, including numerous localities in western Nuevo Leon,[47] extreme southern Coahuila,[48] western Hidalgo,[49] southern Puebla,[50] northern Michoacan [51] and Jalisco west of Lake Chapala.[52] Among these intermediate from the states of Puebla and Michoacan, Mexico there is evident in addition a pronounced and fairly definite, but by no means invariable, tendency toward a more acute fastigio-facial angle when the same is viewed in profile. This is indicated in both sexes, but is not clearly enough marked or sufficiently constant to consider worthy of nominate segregation. It is possible the future may show this tendency is constant and more decided in material from the states of Guerrero or Oaxaca, to the southward, from which areas, however, no material of this species has been seen. This, however, may be a purely local and not at all fixed tendency, such as is seen in a number of areas in *P. delicatula delicatula.* Until more is known concerning this variation I prefer to regard it as comparable to those fluctuations seen in *P. d. delicatula.*

Altitudinally *P. t. texana* typical and atypical is found in Texas only at moderately elevations, nowhere over 2000 feet in elevation, although westward, as the range of *P. t. pusilla* is approached and material is less definitely *P. t. texana,* the species naturally is found at much higher elevations. From Mexico, however, as shown above, typical *P. t. texana* is before me from as high as 5500 feet (Tula River, Tasquillo, Hidalgo).

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[47] Galeana, 5000 feet; VII, 19, 1936; (H. Radclyffe Roberts); 1 ♀; [A.N.S.P.]. Pablillo, Municipio Galeana, 7000–8000 feet; VII, 5 and 8, 1938; (H. Radclyffe Roberts); 2 ♂, 9 ♀; [A.N.S.P.].

[48] Six miles west of Saltillo, 5000 feet; VII, 15, 1936; (H. Radclyffe Roberts); 2 ♂, 3 ♀; [A.N.S.P.].

[49] Kilometer 196 between Zimapan and Ixmiquilpan, 5500 feet; VIII, 2, 1936; (H. Radclyffe Roberts); 8 ♂, 11 ♀; [A.N.S.P.].

[50] Kilometer 226, northwest of Tehuacan, 6500 feet; VIII, 25, 1936; (H. Radclyffe Roberts); 3 ♀; [A.N.S.P.].

[51] Between Zitacuaro and Tuxpan, 5000–6000 feet; VIII, 14, 1940; (H. Radclyffe Roberts); 4 ♂, 4 ♀; [A.N.S.P.]. Five miles south of Chilchota, road to Uruapan, 6000–7000 feet; VIII, 15, 1940; (H. Radclyffe Roberts); 1 ♀; [A.N.S.P.]. Between Zacapa and Zamora, 7500 feet; IX, 6, 1938; (H. Radclyffe Roberts); 1 ♀; [A.N.S.P.].

[52] Between Cocula and Tecolotlan, 5000 feet; VIII, 19, 1940; (H. R. Roberts); 1 ♂; [A.N.S.P.].

Psoloessa texana pusilla (Scudder) (Text-figs. 21–24.)

1899. *Stirapleura pusilla* Scudder, Proc. Amer. Acad. of Arts and Sciences, xxx, p. 52. [♂, ♀; Mesilla, New Mexico (type locality selected in subsequent type designation by Rehn and Hebard, 1912). (In part only, Californian localities originally given referring chiefly to *P. thamnogaea,* here described on a preceding page.)

1903. *Stirapleura mescalero* Rehn, Proc. Acad. Nat. Sci. Phila., 1902, p. 719. [♀; Highrolls, New Mexico.]

Type (by selection of Rehn and Hebard [53]).—♂; Mesilla, Dona Ana County, New Mexico. July 11, 1897. (A. P. Morse.) [Museum of Comparative Zoology, ex Scudder Collection.]

Original material.—On a preceding page in the discussion of the new *Psoloessa thamnogaea* I have considered in detail the various lots of material originally referred to *pusilla* by Scudder. The unique type of *Stirapleura mescalero,* now before me in the Academy series, is clearly representative of the present subspecies.

Synonymy.—Rehn and Hebard established the synonymy of *Stirapleura mescalero* in 1909.[54]

Distribution.—The western and northwestern limits of the range of *P. t. pusilla* in the United States are those of the species in the same directions, and are indicated in available material by Quitobaquita,[55], Growler Valley [56] and Valley of the Ajo,[57] in Pima County, east side of the Plomosa Mountains, 15 miles east of Quartzsite in Yuma County,[58] Kingman [59] in Mohave County, Ash Fork [60] in Yavapai County, ten miles east of Flagstaff,[61] Grand Canyon [62] and Tuba City [63] in Coconino County, Arizona, and Fort Wingate, northwestern New Mexico.[64] South and east of these points in Arizona this subspecies is generally distributed except at the relatively higher elevations.

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[53] Proc. Acad. Nat. Sci. Phila., 1912, p. 92, (1912).
[54] Proc. Acad. Nat. Sci. Phila., 1909, p. 145, footnote 11, (1909).
[55] 1050 feet; IX, 19, 1922; (R. & H.); 1 ♂; [Hebard Cln.].
[56] South of Growler Pass, 1200 feet; IX, 19, 1922; (R. & H.); 1 ♀; [Hebard Cln.].
[57] Six miles north of Ajo, 1600 feet; IX, 16, 1922; (R. & H.); 1 ♂, 1 ♀; [Hebard Cln.]
[58] VIII, 22, 1937; (Rehn, Pate and Rehn); 1 ♂; [A.N.S.P.].
[59] VIII, 2, 1919; (R. & H.); 2 ♂, 6 ♀; [A.N.S.P. and Hebard Cln.].
[60] VIII, 1, 1919; (R. & H.); 3 ♂, 8 ♀; [A.N.S.P. and Hebard Cln.].
[61] VII, 20, 1930; (E. R. Tinkham); 1 ♂, 1 ♀; [Hebard Cln.].
[62] VII, 1, 1929; (P. W. Oman); 2 ♂; [Univ. of Kansas and A.N.S.P.].
[63] 6000 feet; VII, 14–15; (H. S. Colton); 1 ♂, 1 ♀; [A.N.S.P.].
[64] McKinley County; V, 8, 1910; (John Woodgate); 2 ♀; [Hebard Cln. and A.N.S.P.].

The eastern limit of typical *P. t. pusilla* in southern New Mexico and western Texas can be drawn from the Rio Grande Valley in Socorro County, New Mexico [65] and the Tularosa Basin of the same state (Malpais beds near Carrizozo [66]) south to Sierra Blanca [67] and the Quitman Mountains [68] in Hudspeth County, western Texas. From the Sacramento Mountains [69] and the Pecos Valley [70] of New Mexico the representations are definitely atypical *P. t. pusilla,* and the same is true of material from numerous localities in the Guadelupe,[71] Davis,[72] Chinati,[73] Santiago [74] and Chisos [75] Mountains, as well as Kent,[76] Marathon [77] and other related geographically intermediate stations in that section of Texas. Material from La Mesa, Dawson County [78] and Sanderson, Terrell County,[79] Texas is virtually intermediate between *P. t. pusilla* and *P. t. texana,* and it would seem that between these localities and Uvalde and Carrizo Springs, which are approximately 125 to 150 miles to the east and southeast of Sanderson, passage to *P. t. texana* takes place. In northwestern New Mexico the beginnings

[65] Alamillo, 3 miles north of Polvadera, 4600 feet; VII, 20, 1937; (Rehn, Pate and Rehn); 1 ♂; [A.N.S.P.].

[66] Lincoln County; VII, 21, 1930; (E. R. Tinkham); 2 ♀; [Hebard Cln.].

[67] 4524–4950 feet; IX, 13–14, 1912; (R. & H.); 1 ♂; [Hebard Cln.].

[68] 4800–5400 feet; IX, 14, 1912; (H.); 1 ♀; [Hebard Cln.].

[69] Highrolls, Otero County (type locality of *Stirapleura mescalero* Rehn). Elk, Chaves County; VII, 14, 1936; (J. D. Beamer); 1 ♀; [Hebard Cln.]. Hope, Eddy County; VI, 28, 1936; (R. H. Beamer); 6 ♀; [Hebard Cln.].

[70] Carlsbad, Eddy County, 3200–3400 feet; VIII, 25, 1921; (R. & H.); 1 ♀; [Hebard Cln.].

[71] Guadelupe Peak, Culberson County; VII, 19, 1930; (E. R. Tinkham); 1 ♂; [Hebard Cln.].

[72] Slopes of Pine Mountain, Jeff Davis County, 5700–7000 feet; VIII, 29, 1912; (R. & H.); 13 ♂, 4 ♀; [A.N.S.P. and Hebard Cln.]. Maguire Ranch, upper Limpia Canyon, Jeff Davis County, 5600–5800 feet; VIII, 29–30, 1912; (R. & H.); 4 ♂, 1 ♀; [A.N.S.P. and Hebard Cln.].

[73] Presidio County; V, 4, 1930; VIII, 4, 1928; (E. R. Tinkham); 2 ♂, 1 ♀; [Hebard Cln.].

[74] Persimmon Gap, Brewster County, IX, 10, 1912; (R. & H.); 1 ♂, 1 ♀; [A.N.S.P. and Hebard Cln.].

[75] Moss Well, Brewster County, 3250–3300 feet; IX, 8, 1912; (R. & H.); 3 ♂, 11 ♀; [Hebard Cln. and A.N.S.P.]. Canyon behind Pulliam Bluff, Brewster County, 4600–5000 feet; IX, 7, 1912; (R. & H.); 2 ♂, 3 ♀; [Hebard Cln. and A.N.S.P.].

[76] Culberson County, 3700–4200 feet; IX, 17–18, 1912; (R. & H.); 1 ♀; [Hebard Cln.].

[77] Brewster County, 3940–4160 feet; VIII, 26–27, 1912; (R. & H.); 3 ♂, 4 ♀; [A.N.S.P. and Hebard Cln.]: VII, 1–2, 1916; (R.); 2 ♂, 6 ♀; [A.N.S.P. and Hebard Cln.].

[78] V, 15, 1931; (S. E. Jones); 1 ♂; [Hebard Cln.].

[79] VIII, 25, 1912; (R. & H.); 3 ♀; [Hebard Cln.].

of a passage toward *P. t. pawnee* is apparent, Fort Wingate material being atypical *P. t. pusilla,* while at a number of localities in northern and northeastern New Mexico, as Jemez Springs,[80] the vicinity of Tesuque, north of Santa Fé,[81] Tijeras and Tijeras Canyon [82] east of Albuquerque, Las Vegas [83] and Koehler Junction,[84] the representation is definitely intermediate between *P. t. pusilla* and *P. t. pawnee.* A single individual from the Staked Plains of Texas (Brownfield, Terry County [85]) shows the intergradation of *P. t. texana, P. t. pusilla* and *P. t. pawnee.*

In Mexico the most western point known for *P. t. pusilla* is Guaymas, Sonora,[86] from which area this subspecies is distributed at a variety of elevations and in suitable environments eastward and southward typically as far as southern Coahuila (Parras [87]), eastern San Luis Potosi (six miles west of Ciudad Maiz [88]), the eastern part of the state of Mexico (San Juan Teotihuacán [89]) and north-central Jalisco (Guadalajara [90]). Atypically *P. t. pusilla* is indicated as far eastward as central Hidalgo (north of Pachuca) and southward to the central part of the boundary between Jalisco and Michoacan (Tancitaro [91]). Material intermediate between *P. t. pusilla* and *P. t. texana* has been summarized under the latter subspecies.

In altitudinal range within the United States typical and atypical *P. t. pusilla* ranges from as low as 1050 feet in southwestern Ari-

[80] Sandoval County, 6400–7500 feet; V, 17—VIII, 11, 1913; (John Woodgate); 23 ♂, 49 ♀; [Hebard Cln. and A.N.S.P.].

[81] Tesuque Creek, Santa Fé County, 7000 feet; VII, 28, 1919; (R. & H.); 5 ♂, 7 ♀; [Hebard Cln. and A.N.S.P.]. Three miles northeast of Tesuque Pueblo, Santa Fé County, 7200 feet; VII, 19, 1934; (H.); 2 ♂; [Hebard Cln.].

[82] Tijeras, Sandia Mountains, Bernalillo County, 6500 feet; VII, 29, 1919; 2 ♂, 1 ♀; [Hebard Cln.]. Tijeras Canyon, Sandia Mountains, Bernalillo County, 6500 feet; VII, 29, 1919; (R. & H.); 1 ♂; [Hebard Cln. and A.N.S.P.].

[83] San Miguel County; VII, 18, 1936; (J. D. Beamer); 1 ♂; [Hebard Cln.].

[84] Colfax County; VII, 21, 1926; 1 ♀; [Hebard Cln.].

[85] V, 10, 1931; (S. E. Jones); 1 ♀; [Hebard Cln.].

[86] IV, 24, 1921; (E. P. Van Duzee); 1 ♀; [Hebard Cln.].

[87] 5000 feet; VII, 15, 1938; (H. Radclyffe Roberts); 1 ♂, 1 ♀; [A.N.S.P.].

[88] 4500 feet, IX, 9, 1940; (H. Radclyffe Roberts); 1 ♂, 1 ♀; [A.N.S.P.].

[89] VIII, 16, 1933; (E. Carothers); 1 ♂, 7 ♀; [A.N.S.P.].

[90] (Crawford); 6 ♂, 11 ♀; [A.N.S.P.].

[91] 6000 feet; VI, 25, 1941; (R. Hoag and H. Hoogstraal); 2 ♀; [A.N.S.P.].

zona (Quitobaquita) to as high as 6000 feet [92] in northern Arizona (Tuba City) and 6997 in northwestern New Mexico (Fort Wingate), while in southern Arizona it reaches 5000 to 6000 feet (Pinery Canyon, Chiricahua Mountains). It occurs as high as 6650 feet in central (Magdalena [93]) and 6500 in southern (Highrolls) New Mexico, and upwards of 5700 feet in western Texas (slopes of Pine Mountain, Davis Mountains). In Mexico this subspecies ranges from sea-level at its western point (Guaymas, Sonora) to as high as 7500 feet at one of its most southern localities (San Juan Teotihuacán). Intermediates between *P. t. pusilla* and *P. t. pawnee* from northern and northeastern New Mexico occur at somewhat higher elevations than typical or atypical *P. t. pusilla,* reaching to at least 8000 feet (Mesa 2 miles north of Frijoles Canyon, Sandoval County [94]).

Within territory where the ranges of the two species overlap *P. texana pusilla* is frequently found at the same localities and in the same environment as *P. delicatula delicatula,* although the latter requires more of a grassland habitat than *P. texana pusilla,* which form is quite capable of maintaining itself in extremely desert conditions. However, *P. t. pusilla* appears to be completely absent from the lower parts of the Gila Desert of Arizona, the Colorado and Mohave Deserts of California and the Amargosa Desert of Nevada.

Psoloessa texana pawnee new subspecies (Text-figs. 10–13.)

For the description and full discussion of this subspecies see the second portion of the present paper (page 188).

Psoloessa delicatula (Scudder)

Composed of two subspecies, here treated individually. The distribution of the species as a whole is the aggregate of the subspecies.

[92] If material labelled "Grand Canyon" was taken at the canyon rim this should be increased to ± 6500 feet, but we have no information on the exact elevation of the collecting station represented.

[93] Socorro County; VII, 20, 1937; (Rehn, Pate and Rehn); 1♀; [A.N.S.P.].

[94] VIII, 2, 1934; (H.); 1♀; [Hebard Cln.].

Psoloessa delicatula delicatula (Scudder)

(Text-figs. 25–26, 29–37, 46–57.)

1876. *Scyllina delicatula* Scudder, Bull. U. S. Geol. Surv. Terr., II, no. 3, p. 263.[95] [♂; Garden of the Gods, Colorado.]

1876. *Psoloessa ? coloradensis* Thomas, Proc. Davenport Acad. Nat. Sci., I, p. 252, pl. XXXVI, figs. 3 and 4.[96] [♂, ♀; Denver, Colorado.]

1876. *Dociostaurus ornatus* Scudder, Ann. Rep. Chief of Engineers, U. S. Army, 1876, Append. JJ, p. 507.[97] (Also in Wheeler, Ann. Rep. Geogr. Surv. W. 100th Merid., 1876, p. 287.) [♂; Northern New Mexico.]

1876. *Stirapleura decussata* Scudder, Ann. Rep. Chief of Engineers, U. S. Army, 1876, Append. JJ, p. 510.[97] (Also in Wheeler, Ann. Rep. Geogr. Surv. W. 100th Merid., 1876, p. 290.) [♂; Southern Colorado.]

1890. *Psoloessa ? eurotiae* Bruner, Proc. U. S. Nat. Mus., XII, p. 62. [♂, ♀; "Laramie River, just inside the Colorado line."]

1899. *Stirapleura tenuicarina* Scudder, Proc. Amer. Acad. of Arts and Sciences, XXXV, p. 53. [♂; Sierra Blanca, El Paso (now in Hudspeth) County, Texas.]

Type.—♂; Garden of the Gods, Colorado, July 13, 1875. (A. S. Packard.) [Museum of Comparative Zoology, ex Scudder Collection, Type no. 15252.] Lectotype here designated.

Original materials.—I have examined the type material which formed the bases for all of the names here placed in synonymy under *d. delicatula* except that of *Psoloessa ? coloradensis* Thomas. From Hebard's analysis of the existing types of Thomas' species of Orthoptera[98] we can conclude that the original material of *coloradensis* is not in existence. However, there can be little doubt as to the correctness of McNeill's reference of this name to synonymy under *delicatula.* Scudder's original material of *Scyllina delicatula* consisted of two males bearing the same data. The lectotype, here selected, bears three identifying labels: "Garden Gods, July 13;" "Scyllina delicatula Scudd." (in Scudder's handwriting); "Scudder's Type 1876." Of *Dociostaurus ornatus* the unique male type is in the collection of the Museum of Compara-

[95] The cover of separates of the paper containing this description is dated June 6, 1876.

[96] The folios of this paper are dated "June, 1876" and "July, 1876." Whether these dates are those of running through the press, as in some contemporaneous publications bearing them, or actual dates of issue and distribution, cannot be determined from the volume. At any rate it is safe to assume the paper as a whole was not issued before July, 1876.

[97] Letter of transmittal of article to Chief of Engineers dated May 29, 1876, that of Chief of Engineers to the Secretary of War, November 20, 1876.

[98] Proc. Acad. Nat. Sci. Phila., LXXIX, pp. 1–11, (1927).

tive Zoology, ex Scudder Collection (Type no. 15251). It is labelled: "N. N. M." (i.e. Northern New Mexico); "Dociostaurus ornatus Scudd." (in Scudder's handwriting); "Scudder's Type 1876." Similarly *Stirapleura decussata* was based on a unique female in the same collection (Type no. 15249). It is labelled: "S. Col." (i.e. Southern Colorado); "Stirapleura decussata Scudd." (in Scudder's handwriting); "Scudder's Type 1876."

Bruner's *Psoloessa eurotiae* was based on an unstated number of specimens, of which two males and four females originally from the Bruner Collection, included the lectotypic male [99] and allotypic female, are before me in the Hebard Collection. The unique type specimen of *Stirapleura tenuicarina,* in the Museum of Comparative Zoology ex Scudder Collection, bears the following labels: "Sierra Blanca, Tex. June 26, 1897;" "Stirapleura tenuicarina (in Scudder's handwriting). Scudder's Type, 1899."

Synonymy.—McNeill in 1897 [100] first established *Psoloessa ? coloradensis* as a synonym of *Stirapleura decussata.* Caudell in 1903 [101] suggested that *decussata* and *delicatula* might prove "to be forms of one species," and Hebard in 1925 definitely published [102] the synonymy of *Stirapleura decussata* under *delicatula.* Bruner's *Psoloessa eurotiae* was based on examples of *P. d. delicatula* in a pale greenish, lichenose color phase, a condition in my opinion not worthy of nominal recognition.[103] Scudder's *Stirapleura tenuicarina* represents the phase of *d. delicatula* which has the lateral carinae of the pronotum more delicate than in the majority of individuals, and in addition the oblique callose areas on the lateral lobes of the pronotum are relatively weak and broken.

The extensive series of *P. d. delicatula,* totalling nearly a thousand specimens, now before me, shows very definitely that the

[99] See Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1912, p. 63, (1912).
[100] Proc. Davenport Acad. Nat. Sci., VI, p. 271, (1897).
[101] Proc. U. S. Nat. Mus., XXVI, p. 784, (1903).
[102] Proc. Acad. Nat. Sci. Phila., LXXVII, p. 65, (1925).
[103] This same greenish tendency is seen in certain other species of North American Acrididae, particularly *Mestobregma kiowa* in the Yellowstone Region, and *Scirtetica marmorata* in the New Jersey Pine Barrens, and also in certain Tetrigidae. As some of the original specimens on which *eurotiae* was based are much less extreme in these color features than others, uniformity and stability in the prevalence of this color type do not exist, and no constant structural features can be found to give any valid reasons for retaining *eurotiae.*

names which appear in the above synonymy all relate to a single subspecies, in which variation in certain structural features, as well as color pattern and tonal ranges, is very considerable. These variational tendencies are discussed in another section of the present study, as the same general lines of structural variation are recognizable in not only other species of the genus *Psoloessa,* but also in species of related genera or even related genera groups.

Distribution.—Typically *P. d. delicatula,* in its generally preferred short-grass habitat, is of relatively broad distribution in our area, being an inhabitant of the Great Plains region, the more southern Rocky Mountains, the plateau sections of the southwestern United States and much of the southern portion of the Basin and Range Province (i.e. "Great Basin"). Northward it ranges at least as far as Aweme [104] and Chater,[105] Manitoba; Langham and Saskatoon,[106] Saskatchewan, and Medicine Hat [107] and Calgary,[108] Alberta. The most northeasterly points, aside from Aweme and Chater, from which I have seen this subspecies, and incidentally the species are Devil's Lake and Oakes,[109] North Dakota, while the eastern boundary is indicated by Geddes,[110] South Dakota; Ainsworth [111] and Broken Bow,[112] Nebraska; Phillips,[113] Rush [114] and Clark [115] Counties, Kansas; Kenton,[116] Boise City [117] and eight miles southeast of Guymon,[118] Oklahoma, and

[104] VI, 7–9, VII, 9–29, 1909; (Criddle); 4 ♂, 10 ♀; [A.N.S.P. and Hebard Cln.].
[105] V, 29, 1936; (R. D. Bird); 1 ♂; [Hebard Cln.].
[106] V, 9–12, 1923; (N. J. Atkinson and Kenneth M. King); 2 ♂, 2 ♀; [Hebard Cln.].
[107] VI, 13, 1905; 9 ♂, 8 ♀; [Cornell Univ., A.N.S.P. and Hebard Cln.].
[108] V, 12, 1922; 1 ♀; [Hebard Cln.].
[109] IX, 9, 1934; (J. A. Monro and O. A. Stevens); 1 ♀ in instar preceding maturity; [Hebard Cln.].
[110] V, 16, 1918; (C. N. Ainslie); 1 ♀; [Hebard Cln.].
[111] 1 ♂; [Hebard Cln.].
[112] VII, 1889; 1 ♀; [Hebard Cln.].
[113] VII, 8, 1925; (Howard Deay); 1 ♀; [Hebard Cln.].
[114] 2060 feet; VI, 28, 1912; (F. X. Williams); 2 ♂, 2 ♀; [Univ. of Kansas and Hebard Cln.].
[115] 1962 feet; V; (F. H. Snow); 1 ♂, 1 ♀; [Univ. of Kansas and Hebard Cln.].
[116] Cimarron County; VI, 27, 1933; (E. E. Ivy); 1 ♀; [Hebard Cln.]: VII, 3–7, 1926; (T. H. Hubbell); 10 ♂, 9 ♀; [Univ. of Mich., A.N.S.P. and Hebard Cln.].
[117] Cimarron County; VI, 30, 1926; (T. H. Hubbell); 2 ♀; [Univ. of Mich. and A.N.S.P.].
[118] Texas County; VI, 28, 1926; (T. H. Hubbell); 1 ♂; [Univ. of Mich.].

Pampa,[119] La Mesa [120] and Marathon,[121] Texas. In Arizona it has been taken at a number of scattered, more elevated and usually grassland localities south of the escarpment of the Colorado Plateau, as Sulphur Springs Valley,[122] Pinery Canyon in the Chiricahua Mountains,[123] Fort Grant,[124] Naco,[125] Nogales,[126] and the Santa Rita [127] and Baboquivari [128] Mountains, while north of the Tonto Escarpment it is much more generally distributed except at relatively quite high elevations. The westernmost localities from which typical *d. delicatula* is known, on the basis of determinable adult material, are Limespur, Montana;[129] Crestline, Nevada;[130] Peach Springs, Arizona,[131] and Silver Canyon in the White Mountains [132] of extreme eastern California, the latter exemplifying the localization of the species in particularly favorable conditions in a region largely unsuited to it. On many of the isolated mountain ranges of central Nevada the genus, and probably this species, is known to occur, but on the basis of immature material only, and the degree of intergradation with *P. d. buckelli,* which individuals from these localities might show, cannot at present be ascertained.

Atypically *P. d. delicatula* is known to me to occur at least as far northwestward as Warner Lake [133] and Burns,[134] Oregon, and evidence of atypical character is clearly marked over the Basin and Range Province as far to the southward of these two Oregon

[119] V, 7, 1931; (S. E. Jones); 1♀; [Hebard Cln.].
[120] Hebard, in manuscript.
[121] 4160 feet; VIII, 26, 1912; (R. & H.); 1♂, 3♀; [A.N.S.P. and Hebard Cln.]: VIII, 20, 1916; (R.); 1♂; [Hebard Cln.].
[122] Six miles S.E. of town of Light; VII, 7, 1919; (Witmer Stone); 1♀; [A.N.S.P.]. Six miles S.W. of Dos Cabezos; V, 29, 1919; (Witmer Stone); 1♀; [A.N.S.P.].
[123] 5000–6000 feet; V, 22, VII, 12–15, 1919; (Witmer Stone); 8♂, 9♀; [A.N.S.P. and Hebard Cln.].
[124] 1882; 2♂, 2♀; [Hebard Cln.].
[125] IV, 27, VI, 15, 1932; (E. D. Ball); 4♂, 12♀; [Hebard Cln. and A.N.S.P.].
[126] IV, 23, 1932; (E. D. Ball); 1♀; [Hebard Cln.].
[127] 5000–8000 feet; VII; (F. H. Snow); 6♂, 9♀; [Hebard Cln. and A.N.S.P.]: IV, 29, 1932; (E. D. Ball); 7♀; [Hebard Cln. and A.N.S.P.].
[128] IV, 11, V, 17, VI, 9, VII, 16, 1932; (E. D. Ball); 2♂, 6♀; [Hebard Cln.]: VII, 16, 1932; (R. H. Beamer); 4♀; [Hebard Cln.].
[129] V, 27, 1911; (J. R. Parker); 2♀; [Hebard Cln.].
[130] 6000 feet; IX, 4, 1909; (R. & H.); 1♀; [Hebard Cln.].
[131] VI, 30, 1932; (E. D. Ball); 2♀; [Hebard Cln.].
[132] 8200–8300 feet; IX, 10, 1919; (R. & H.); 1♀; [Hebard Cln.].
[133] VI, 21, 1922; (E. C. Van Dyke); 2♂; [Hebard Cln.].
[134] V, 15; (B. G. Thompson); 1♂, 1♀; [Hebard Cln.].

localities as Grand Junction, Colorado [135] and Salt Lake City, Utah,[136] while individuals from as far northeastward as Forsyth [137] and Huntley [138] on the Yellowstone River in east central Montana evidence, by their atypical condition, the degree to which the influence of the northwestern *P. d. buckelli,* coming in from the Snake River plains of southern Idaho, has penetrated via the avenue of the Big Horn Valley of Wyoming into the plains of the upper Yellowstone in Montana. From an extensive area comprising portions of southern Montana, southern Idaho, the Big Horn Valley of Wyoming and northwestern Utah the representations are seen to be intermediate between *P. d. delicatula* and *P. d. buckelli,* this representing the extensive area of intergradation of the two subspecies.

Under the distribution of *P. d. buckelli* I have given the area in which that subspecies occurs atypically, showing that an extensive tongue of its distribution extends southward into western Wyoming, surrounded on the east and west, and probably south, by territory in which the representatives of *delicatula* are intermediate between *d. delicatula* and *d. buckelli.*

South of the United States border we know *P. delicatula delicatula* only from a single locality, although undoubtedly it is distributed over a considerable part of the more elevated sections of northern Mexico where its preferred habitat, i.e. short grass plains, occurs. Meseta de la Zarca, northern Durango,[139] at an elevation of 6000 feet is the single locality from which we have seen material, and this is typical of *d. delicatula,* much resembling southern Arizona series.

The vertical distribution of *delicatula delicatula* exhibits a very considerable range, but this is largely due to the extensive latitudinal distribution of the subspecies. Speaking broadly, to the northward it occurs at lower elevations than to the southward, as would be expected from its general zonal correlations, while the maximum elevation known for the subspecies is in the western

[135] 1 ♂, 1 ♀; [Hebard Cln.].
[136] 1 ♀; [Brooklyn Inst.].
[137] 2600 feet; V, 27, 1903; 3 ♀; [A.N.S.P.].
[138] V, 7, 1914; 2 ♀; [A.N.S.P.].
[139] VII, 17, 1938; (H. R. Roberts); 3 ♂, 7 ♀; [A.N.S.P.]. This locality is about 50 miles west of Mapimi, its approximate position 25° 45′ N, 104° 45′ W.

portion of its range (White Mountains of California), where, however, strongly modifying surface conditions may be entirely responsible. In the limited Canadian section of the range of *d. delicatula* it is known to occur as high as 3425 feet in Alberta (Calgary) and as low as 1644 feet in Manitoba (Deloraine). Doubtless it occurs higher and to the westward of Calgary, closer to, if not actually on, the eastern slopes of the Canadian Rockies. In North Dakota it is known from as low as 1465 feet (Devils Lake); in South Dakota from as low as 1493 feet (Geddes) to as high as 5300 feet (Custer),[140] while in Nebraska it is known to range as low as 2525 feet (Ainsworth) and as high as 4000 feet (Alliance),[141] and in Kansas from 1962 feet (Clark County) to 3350 feet (Hamilton County).[142] Montana is represented by material from localities as low as 2600 feet (Forsyth) to as high as 3116 feet (Sidney),[143] but atypical individuals and material intermediate between *d. delicatula* and *d. buckelli* represent localities as high as 4800 feet (Bozeman).[144] In Wyoming this insect occurs at localities reaching from the lowest elevations in the state to as high as 7150 feet (Laramie),[145] while in Colorado a similar minimum point is found, with the maximum at 8900 feet (Dark Canyon, Pike's Peak).[146] Moving southward we find the altitudinal range very similar in New Mexico, or from near the lowest elevations in the state (3900 feet) up to 7825 (Datil Canyon, Datil Range)[147] and 9100 feet (Ridge between Chupidero and Rio en Medio Canyons, Sangre de Cristo range),[148] while in the limited area of Texas inhabited by this species the elevations represented range from 3200 feet (Pampa) to 7000 feet (Slopes of Pine Mountain).[149]

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[140] VIII, 1888; 1♀; [Hebard Cln.].

[141] Boxbutte County; VII, 14, 1909; (R.); 1♀; [A.N.S.P.].

[142] VI, 1902 (in part); (F. H. Snow); 8♂, 7♀; [Univ. of Kansas, A.N.S.P. and Mont. Exper. Sta.].

[143] Dawson County; VI, 13–16, 1913; 2♀; [Mont. Exper. Sta.].

[144] Gallatin County; IV, 22, 1905, V, 10–31 (1903–1906), VI, 2–26 (1904–1906), VII, 2 and 3, 1906, VIII, 20, 1911; 14♂, 26♀; [Mont. Exper. Sta. and A.N.S.P.].

[145] Albany County; 2♀; [Hebard Cln.].

[146] El Paso County; VI, 22, 1915; (H. B. Baker); 1♂; [A.N.S.P.].

[147] Catron County; VII, 21, 1937; (Rehn, Pate and Rehn); 4♂, 14♀; [A.N.S.P.].

[148] VII, 19, 1934; (M. Hebard); 1♂; [Hebard Cln.].

[149] Davis Mountains, Jeff Davis County; VIII, 29, 1912; (R. & H.); 13♂, 4♀; [Hebard Cln. and A.N.S.P.].

Arizona exhibits a noteworthy amount of altitudinal range, or from about 3850 feet (Nogales) to at least 7450 feet (Navajo Point).[150] In Utah the range of typical *delicatula* is from 2700 feet (St. George) [151] to at least 7000 feet (Buckskin Valley).[152] The single Nevada locality for adult material is at an elevation of 6000 feet (Crestline), but immature individuals were taken as low as 4000 feet (Lee Canyon, Spring Mountains) [153] and as high as 8000–8200 feet (Wassuk Range).[154] In the White Mountains of eastern California the single adult seen was taken at 8200–8300 feet, but immature individuals were seen up to 10,600 feet. In Oregon this subspecies was taken at 4600 (Warner Lake) and 3800 feet (Burns).

Psoloessa delicatula buckelli Rehn (Text-figs. 27–28, 38–45.)

1937. *Psoloessa delicatula buckelli* Rehn, Trans. Amer. Entom. Soc., LXIII, p. 326. [♂, ♀; Oliver (type locality), Naramata and Penticton, Okanagan Lake, Yale District, British Columbia; Vaseaux Lake, Fairview, Osoyoos, Rock Creek and Ox Falls, Okanagan region, Yale District, British Columbia; Pressy's, Wenass Valley, Yakima County, Washington.]

Type.—♂; Oliver, Okanagan Lake, Yale District, British Columbia, May 10, 1903. (E. R. Buckell.) [Academy of Natural Sciences of Philadelphia, Type no. 5569.]

Original material.—Virtually all the originally studied material has been re-examined.

Distribution.—Typical *P. d. buckelli* is limited to the interior region of extreme southern British Columbia and the Columbia Plains and Coulee country of Washington. All of the British Columbia localities known to me are in the Okanagan Valley or, across a low divide to the eastward, on the Kettle River (Rock Creek), a southward flowing direct tributary of the main Columbia River. The localities at present known for Washington are Oroville in the Okanogan River at the south end of Osoyoos Lake,[155]

[150] Grand Canyon, Coconino County; X, 4, 1919; (H.); 1 juv. ♂, 4 juv. ♀; [Hebard Cln.].

[151] Washington County; (G. P. Englehart); 1♀; [A.N.S.P.].

[152] Iron County; 2♀; [Brooklyn Inst.].

[153] Clark County; VIII, 18–22, 1919; (R. & H.) 4 juv. ♀; [Hebard Cln. and A.N.S.P.].

[154] Summit of Pass, Mineral County; IX, 13, 1919; (R. & H.); 2 juv. ♂, 2 juv. ♀; [Hebard Cln.].

[155] Okanogan County; V, 10, 1912; 1♀; [Hebard Cln.].

Brewster, farther south on the same stream,[156] the Grand Coulee (Steamboat Rock,[157] Coulee City[158] and Foster Coulee[159]) and Pressy's, Wenass Valley, Yakima County, the latter the most southern point from which typical *P. d. buckelli* is known. Atypically *P. d. buckelli* extends as far as the Yellowstone National Park (Norris Basin) and southwestern Wyoming (Cokeville and Evanston). A discussion of the intergradation of *P. d. delicatula* and *P. d. buckelli* was presented in 1937 with the original description of the latter species (pp. 330–331).

V. Morphological Size and Color Variation in and Bionomics of Psoloessa delicatula delicatula

In the course of studies made during the past twenty years I have been able to examine a series of nearly one thousand adult specimens of this subspecies, representing over one hundred and twenty-five localities. This very ample and comprehensive representation permitted me to note critically the variations observed, and as these are of definite value, not only in weighing the extent to which fluctuations are encountered in the present genus, but unquestionably in related genera as well, they are here given for the student's consideration.

Structure.—The noteworthy variation displayed in morphological features in the extensive series of this form examined, falls naturally into two groups, i.e. that which represents divergence toward and intergradation with the subspecies *delicatula buckelli,* and that illustrating structural variation in material which is typically *delicatula delicatula.* As the latter more pertinently represents individual variation or inherent tendencies within the subspecies, and is also essentially paralleled in *S. delicatula buckelli* and intermediate material, it will be discussed first.

There is in this species and subspecies, and for that matter in this genus and certain related ones, a very markedly degree of variation in several features that are generally characters of marked fixity, several of which in not distantly related genera groups have

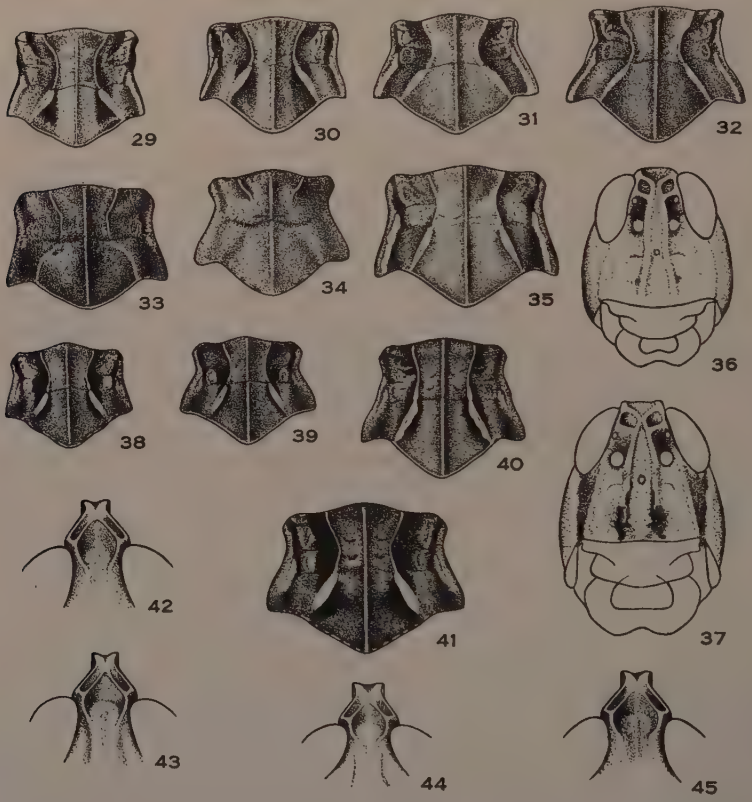
[156] Okanogan County; V, 12; (M. A. Yothers); 2♀; [Hebard Cln.].
[157] Grant County; VII, 10, 1902; 1♂; [Wash. State College].
[158] Grant County; VI, 25, 1902; 1♀; [Wash. State College]. This individual has a shorter pronotum than usual in *P. d. buckelli* and more clepsydral lateral carinae, but otherwise is typical of this subspecies.
[159] Grant County; VI, 24, 1902; 2♀; [Wash. State College].

been used as generic criteria. These are, the relative proportions of the pronotal disk, i.e. length to breadth, the emphasis and continuity of the lateral carinae of the pronotal disk, their shape and degree of divergence, and the relative length and breadth of the fastigium.[160]

The pronotal length to breadth, as a whole or of the disk alone, varies quite appreciably even in the same series, and there is no sexual or geographic correlation. The fluctuation of greatest frequency, and therefore most misleading variability, is the degree of divergence of the lateral carinae of the pronotal disk cephalad and caudad of their median constriction, as well as the arcuation or straightness of the same carinae. This is frequently but by no means invariably correlated with the relative length of the pronotal disk, i.e. those individuals with the carinae more sharply diverging caudad in such cases have shorter pronota, those with less sharply caudad diverging carinae have more elongate pronota. This correlation, however, is not the rule and is mentioned only to show that no uniform association of pronotal length and relative divergence and curvature of the lateral carinae exists. The clepsydral character of the lateral carinae is always apparent, but the variation is in the degree of straightness or curvature of the diverging cephalic and caudal sections of these carinae. In the shorter pronota the rule is to find both sections with the carinae very appreciably arcuate divergent, convex laterad on each, producing very decidedly what has been called a "strangulate" effect, in allusion to their contiguity or constriction mesad. In the more elongate pronota the carinae of the cephalic section are usually somewhat straighter, that is more straight divergent than in the shorter type, but this is variable; the caudal portions of the lateral carinae are straight divergent in a larger percentage of the material examined, being truly arcuate in but a small percentage. As the gauging of much of the variation which is near the borderland of "arcuate" and "straight" would be very largely a matter of personal equation,

[160] As explained beyond, in discussing these two dimensions, they refer to the proportions of the entire fastigial depression as seen from the dorsum, and not alone to the excavate section cephalad of the transverse impression, the proportions of which limited section of the fastigium have been used as a feature in the preceding key to the forms of the genus. The key has been drawn sufficiently broad in its emphasis to embrace as far as possible the known variation of the forms treated.

I have thought it unwise to give percentages or concrete figures, but instead merely to state the conclusions which seem warranted. It must be borne in mind that in individuals with the more elongate



Psoloessa delicatula delicatula (Scudder). Dorsal views of pronota to illustrate carinal development and pattern ranges: females; figs. 29 and 30 (× 4)—Morton Co., Kansas; figs. 31 and 32 (× 4)—Pine Mountain, Texas; fig. 33 (× 6)—Sierra Blanca, Texas (*type* of *Stirapleura tenuicarina* Scudder); fig. 34 (× 4)—South Creek, Beaver Co., Utah: male; fig. 35 (× 6)—Pine Mountain, Texas. Pattern of face (females); figs. 36 and 37 (× 5)—Gray Creek, Colorado.

Psoloessa delicatula buckelli Rehn. Dorsal views of pronota to illustrate carinal development and pattern ranges (× 4); Oliver, British Columbia: figs. 38 and 39, males (*paratypes*); figs. 40 and 41, females (*paratypes*). Fastigia from dorsum (greatly enlarged); Oliver, British Columbia: figs. 42 and 43, males (*paratypes*); figs. 44 and 45, females (*paratypes*).

pronota the width has not increased in the same ratio as length; in consequence the caudal width of the disk is less in proportion to the length of the same, and accordingly the longer lateral carinae diverge less decidedly, giving what to the casual observer would be considered a marked difference from the other extreme condition. Any series of reasonable size from a single locality will show the two conditions inextricably connected by intermediates, and without sexual correlation, although the more elongate pronotum type apparently is more frequent and decided in the female sex.

The most puzzling feature of individual structural variation is the occasional partial suppression of the lateral carinae of the pronotum, or at least a marked decrease in thickness and intensity of these ridges, giving them in the latter condition a delicacy rather different from the more usual accentuation. The suppression of the carinae may be indicated on but the metazona, or it may be nearly entire, in which case the result is a quite different looking insect from the usual heavily clepsydrally carinate type. There is in connection with this tendency a very definite geographic correlation, as I have observed it only in material from southern and south-central New Mexico (Magdalena,[161] 1 ♂; Silver City, 1 ♀; Aden, 2 ♂; Alamogordo, 2 ♀), south and central Arizona (Prescott,[162] 1 ♂; 25 miles northwest of Springerville,[163] 1 ♂; Fort Grant,[164] 1 ♀; Chiricahua Mountains,[165] 2 ♀; Santa Rita Mountains, 1 ♀; Naco,[166] 1 ♂; Baboquivari Mountains,[167] 3 ♂, 9 ♀), south-central Utah (South Creek, Beaver County,[168] 4 ♀; Beaver Creek Hills, Beaver County,[169] 3 ♂, 1 ♀; Beaver Canyon,[170] 1 ♀; Buckskin Valley, Iron County,[171] 1 ♀), and Durango, Mexico

[161] Socorro County, 6650 feet; VII, 20, 1937; (Rehn, Pate & Rehn); 1 ♂; [A.N.S.P.].
[162] Yavapai County; VII, 10–25, VIII, 1, 1917; (O. C. Poling); 6 ♂, 7 ♀; [Hebard Cln. and A.N.S.P.].
[163] Apache County, 6725 feet; VII, 22, 1937; (Rehn, Pate & Rehn); 1 ♂, 1 ♀; [A.N.S.P.].
[164] Graham County; 1882; 2 ♂, 2 ♀; [Hebard Cln.].
[165] Cochise County; IV, 30, VI, 17, 1932; (E. D. Ball); 15 ♀; [A.N.S.P. and Hebard Cln.].
[166] Cochise County; VI, 15, 1932; (E. D. Ball); 5 ♂, 12 ♀; [Hebard Cln.].
[167] Pima County; IV, 11, VI, 9, VII, 16–17, 1932; (E. D. Ball); 4 ♂, 14 ♀; [A.N.S.P. and Hebard Cln.].
[168] 4 ♀; [Hebard Cln.].
[169] 7 ♂, 1 ♀; [Hebard Cln.].
[170] Beaver County; 1 ♀; [Hebard Cln.].
[171] 2 ♀; [Hebard Cln.].

(Meseta de la Zarca, 2 ♀[172]). From these data it will be seen that this tendency is not restricted to either sex, although more frequent in the female. This partial suppression of the lateral carinae is usually associated with a very uniform reddish color of the pronotum, and to some extent of the tegmina. Other individuals from the same localities with normally developed lateral carinae generally have the coloration of the pronotum of the more usual strongly diversified type. In the Baboquivari Mountains, Arizona and the South Creek, Utah females the suppression of the carinae is probably more complete than in the others listed above. The percentage of this condition in the larger or more important series showing it are as follows:

Silver City, New Mexico, 1 ♀ of total of 24 ♂, 40 ♀, or 1.5%.

Aden, New Mexico, 2 ♀ of total of 20 ♂, 9 ♀, or 6.8%.

Prescott, Arizona, 1 ♂ of total of 6 ♂, 7 ♀, or 7.7%.

Chiricahua Mountains, Arizona, 2 ♀ of total of 15 ♀, or 13.3%.

Santa Rita Mountains, Arizona, 1 ♀ of total of 9 ♀, or 11%.

Naco, Arizona, 1 ♂ of total of 5 ♂, 12 ♀, or 5.7%.

Baboquivari Mountains, Arizona, 3 ♂, 9 ♀ of total of 4 ♂, 14 ♀, or 66%.

Meseta de la Zarca, Durango, Mexico, 2 ♀ of total of 3 ♂, 7 ♀, or 20%.

South Creek, Utah, 4 ♀ of total of 4 ♀, or 100%.

Beaver Creek Hills, Utah, 3 ♂, 1 ♀ of total of 7 ♂, 1 ♀, or 50%.

It is thus evident there is a regional preponderance of this condition, and it is quite possible that we have in it a species or subspecies in the making, but the intermediate conditions are sufficiently numerous and regular in degree to show the intimate relationship of the two types. In numerous specimens which apparently have well developed lateral carinae on the metazona of the pronotal disk it is evident that their chief emphasis there is due to the pale coloration, and that the structural presence of the carinae is very weak.

The relative breadth and length of the fastigium, both in its outline as seen from the dorsum and in its cephalic angle, as well as that of the relative disposition of the lateral foveolae, varies

[172] 6000 feet; VII, 17, 1938; (H. R. Roberts); 3 ♂, 7 ♀; [A.N.S.P.]. This locality is approximately 50 miles west of Mapimi. Position roughly 25° 45′ N, 104° 45′ W.

very greatly, individually and regardless of sex. The conditions noted, however, are not in any way peculiar to this species, but are found in related ones and those of allied genera, so that the instability we find here is a feature of many forms of a considerable group.

There seems to be no geographic correlation or even preponderance of the tendency toward variability in the fastigial proportions, and the localities detailed below are represented by marked extremes in this feature.

The series from Datil Canyon, Datil Mountains and Silver City, New Mexico, and Pinery Canyon, Chiricahua Mountains, Arizona embrace the greatest ranges of variation in fastigial proportions, particularly in the male sex, while the representations of females from Philip, South Dakota,[173] Clifton House, New Mexico [174] and the Baboquivari Mountains, Arizona exhibit the most decided variation in proportions of the fastigial depression found in the extensive representation of that sex. The measurements here given in millimeter decimals are of extremes of the fastigial depression (length and breadth) in the large series examined, together with the degree of the angle of the cephalic margin of the same.

	Length	Breadth	Angle (in degrees)
♂, Philip, South Dakota	.63	.58	100
♂, Philip, South Dakota	.54	.46	80
♀, Philip, South Dakota	.79	.71	96
♀, Philip, South Dakota	.58	.54	86
♂, Trinidad, Colorado [175]	.58	.54	94
♂, Trinidad, Colorado	.54	.37	86
♂, Gray Creek, Colorado [176]	.67	.63	100
♂, Gray Creek, Colorado	.75	.71	86
♀, Clifton House, New Mexico	.65	.65	90
♀, Clifton House, New Mexico	.70	.60	90
♂, Taos Valley, New Mexico [177]	.54	.42	80
♂, Taos Valley, New Mexico	.63	.50	90
♀, Taos Valley, New Mexico	.67	.54	96
♀, Taos Valley, New Mexico	.71	.71	106
♂, Satan Pass, New Mexico [178]	.60	.40	85

[173] Stanley County; V, 16, 1919; 1 ♂, 2 ♀: VI, 23, 1923; (H. C. Severin); 3 ♂, 2 ♀; [Hebard Cln.].

[174] Colfax County, 6355 feet; VII, 12, 1937; (Rehn, Pate and Rehn); 1 ♂, 3 ♀; [A.N.S.P.]: VIII, 4, 1921; (R.); 1 ♂, 2 ♀; [Hebard Cln.].

	Length	Breadth	Angle (in degrees)
♂, Satan Pass, New Mexico	.55	.45	100
♀, Satan Pass, New Mexico	.70	.55	110
♀, Satan Pass, New Mexico	.70	.60	90
♂, Datil Canyon, New Mexico [179]	.50	.45	90
♂, Datil Canyon, New Mexico	.70	.50	90
♀, Datil Canyon, New Mexico	.60	.60	95
♀, Datil Canyon, New Mexico	.80	.65	110
♂, Silver City, New Mexico	.71	.42	80
♂, Silver City, New Mexico	.63	.58	96
♀, Silver City, New Mexico	.79	.63	100
♀, Silver City, New Mexico	.71	.63	96
♂, Ash Fork, Arizona [180]	.63	.46	80
♂, Ash Fork, Arizona	.58	.33	70
♂, Natames Plateau, Arizona [181]	.70	.50	86
♂, Natames Plateau, Arizona	.75	.55	90
♂, Pinery Canyon, Chiricahua Mountains, Arizona	.71	.42	74
♂, Pinery Canyon, Chiricahua Mountains, Arizona	.71	.54	80
♀, Pinery Canyon, Chiricahua Mountains, Arizona	.79	.63	86
♀, Pinery Canyon, Chiricahua Mountains, Arizona	.79	.71	100
♂, Baboquivari Mountains, Arizona	.70	.50	90
♂, Baboquivari Mountains, Arizona	.75	.60	90
♀, Baboquivari Mountains, Arizona	.70	.75	112
♀, Baboquivari Mountains, Arizona	1.00	.85	95
♀, Marathon, Texas	.84	.84	96
♀, Marathon, Texas	.84	.67	86
♀, Silver Canyon Trail, White Mountains, California	.88	.63	80

[175] Las Animas County; VII, 23–25, 1919; (R. & H.); 23 ♂, 9 ♀; [Hebard Cln. and A.N.S.P.].

[176] Las Animas County; VII, 24, 1919; (R. & H.); 6 ♂, 8 ♀; [Hebard Cln.].

[177] Taos County; V, 30 and V and VI, 1883; 2 ♂, 3 ♀; [Hebard Cln.].

[178] North side of pass, 7 miles south of Crown Point, McKinley County, 7100 feet; VII, 17, 1937; (Rehn, Pate and Rehn); 2 ♂, 3 ♀; [A.N.S.P.].

[179] Datil Range, Catron County, 7825 feet; VII, 20, 1937; (Rehn, Pate and Rehn); 4 ♂, 14 ♀; [A.N.S.P.].

[180] Yavapai County; VIII, 1, 1919; (R. & H.); 6 ♂, 2 ♀; [Hebard Cln. and A.N.S.P.].

[181] Near Chrysotile, Gila County, 5100 feet; VII, 22, 1937; (Rehn, Pate and Rehn); 3 ♂; [A.N.S.P.].

From these figures it is evident that in each sex there is a marked degree of variation in proportions of the impressed dorsal area of the fastigium, and that while this area in the female sex averages shorter and broader, and in the male longer and narrower,

Psoloessa delicatula delicatula (Scudder). Fastigia from dorsum (greatly enlarged). Males; fig. 46—Philip, South Dakota; fig. 47—Trinidad, Colorado; fig. 48—Philip, South Dakota; figs. 49 and 50—Silver City, New Mexico. Females; figs. 51 and 52—Philip, South Dakota; fig. 53—Gray Creek, Colorado; fig. 54—Silver City, New Mexico; fig. 55—Marathon, Texas; fig. 56—Pinery Canyon, Chiricahua Mts., Arizona; fig. 57—Silver Canyon Trail, White Mts., Cal.

the correlation is not absolute, as evidenced by a female from Philip, South Dakota and a male from Trinidad, Colorado having identical proportions. Whether the very narrow, elongate fastigial disk of the female from Silver Canyon Trail, White Mountains,

California is more than an individual feature, remains to be determined when additional material is available, but in this connection note also the proportions of one of the Ash Fork, Arizona males and the two Marathon, Texas females. As the shape of the lateral boundaries of the fastigial depression, i.e. the lateral margins of the fastigium, varies very appreciably, it is somewhat difficult to define the length as measured. However, I have taken it cephalad of a line drawn between the faint angles which are almost always present in these margins at a point where they weakly converge and partly enclose the fastigial disk caudad. Rarely no angle is indicated and the carinae die out without converging, but this is purely a variational feature and for comparison the length then has been considered as from the average position of the angle when present.

The degree of the angle of the cephalic margin of the fastigial disk is seen from the above table to be distinctly variable, in the male sex ranging from 70 to 100°, in the female from 80 to 112°. Reference to the figures given above will show that the degree of this angle is not at all directly correlated with the relative proportions of the fastigial disk, and consequently the exact shape and proportions of the disk may vary very greatly in two individuals of the same sex having the same degree of angulation, or conversely two having the same or approximately the same dimensions may show a marked difference in the degree of angulation of the cephalic margin.

A feature of structural variation that very readily could be productive of uncertainty in placing material, and which is clearly individual, is in the proportion of the greatest width of the head across the genae compared with the depth of the head. Variability in this feature is not frequent, and when present is often very weak, but in the series of eight females from Gray Creek, Colorado the extremes are quite marked, in one the greatest genal width being 3.94 mm. to a greatest head depth of 6.04 mm., or decimally expressed the width equalling 64.2% of the depth; the other extreme has the greatest genal width 3.69 mm. to a head depth of 5.46 mm. or with the width equalling 67.5% of the depth. This inflation of the head involves more than the genae, as by slightly shifting the axes of the eyes as seen in cephalic aspect, the whole

physiognomy of the insect is altered. The Gray Creek series of females intimately connects the two extremes of that representation, and similar tendencies in other lots show conclusively that this plasticity in head width has no taxonomic significance.

With the tendency toward unusual bullation of the head across the genae is usually correlated a slight but appreciable variability in the degree of divergence ventrad of the lateral margins of the frontal costa, a wider divergence in those with more inflated genae and vice versa. This, however, is by no means invariable, either in the association of more divergent costal margins with a broader head, or less divergent margins with a narrower head. The variation found in the divergence of the lateral margins is not marked, but sometimes is sufficient to raise a question in the mind of the student as to the specific identity of certain individuals.

The degree of sulcation of the dorsal and median sections of the frontal costa is appreciably variable, both in the areal extent of the excavation and in its depth. No material of this species or subspecies has been seen which could be called non-sulcate, but frequently the depression of this area within the lateral margins is weak. As a general proposition the dorsal and median sections of the costa are distinctly sulcate, not deeply but broadly, often with a brief area immediately dorsad of the median ocellus but faintly impressed. There is also some little variation in the degree of indication of the ventral section of the frontal costa, governed as it is by the degree and extent to which the lateral margins of the same are similarly evidenced.

The interantennal width of the frontal costa varies very appreciably and individually in both sexes in series of any size, in this respect the condition being parallel to that noted in certain related genera. This variation in width naturally carries with its correlated variation in the obliquity of the lateral borders of the frontal costa in that section, as seen in cephalic aspect.

Turning now to the morphological features which show divergence toward and intergradation with *S. d. buckelli,* the most evident in the latter form as compared with typical *delicatula* are the more compressed form of the whole insect, the more elongate and more sharply angulate fastigium, the more elongate pronotum, with much less evidently diverging lateral carinae of the disk, the more

decided fastigio-facial angle as seen in profile, and the much less evident callose areas on the lateral lobes of the pronotum. The degree of approximation to *d. buckelli* in these features, in material not fully typical of either *d. delicatula* or *d. buckelli,* is indicated by my appraisal of the series from a locality as "atypical *d. delicatula,*" "intermediate" or "atypical *d. buckelli.*" [182] It is not practicable to give in print the exact reasons for one's conclusion in this respect for each series, as they are relative and sometimes based on approximations which are not always evident at the first examination, and the final position of material, in this respect, has been determined only after numerous inspections.

As is frequently and expectedly the case in material intermediate between two geographic races, a considerable percentage of the specimens in intermediate series is not made up of exact intermediates, but, instead, of specimens throwing one way or the other, and the intermediate character of the series as a whole is on the sum total of the representation. This is particularly the case with the large series from Bozeman, Montana [183] and Worland, Wyoming.[184] In these specimens we find marked variation in size, relative length and width of pronotal disk, degree of divergence caudad of lateral carinae of the pronotal disk, curvature or straightness of the same, as well as angulation of the fastigium. The aggregate and numerous individuals of these series would be intermediate; at the same time a number are nearer one or the other subspecies.

Size.—The following measurements (in millimeters) have been taken from material which represents the extremes of size range in series showing appreciable variation in this respect, or of a representative or average individual of the sex where the series exhibits size uniformity, or when but a single specimen is available from a geographically important locality.

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[182] See my description of *P. delicatula buckelli* (Trans. Amer. Entom. Soc., LXII, pp. 330–332, (1937)). I have found these types of categories the most practical and as minutely exact as possible in evaluating series of proved intergrading subspecies.

[183] Gallatin County, 4800 feet; IV, 22, 1905, V, 10–31 (1903–1916), VI, 2–26 (1904–1906), VII, 2 and 3, 1906, VIII, 20, 1911; 14 ♂, 26 ♀; [Mont. Exp. Sta., A.N.S.P. and Hebard Cln.].

[184] Big Horn County; IV, 20–30, 1911; (L. Bruner); 11 ♂, 22 ♀; [Hebard Cln. and A.N.S.P.].

Typical *P. delicatula delicatula*

♂	Length of body	Length of pronotum	Length of tegmen	Length of caudal femur
Medicine Hat, Alberta	11.2	2.5	10.3	7.5
Medicine Hat, Alberta	13	3.1	12	9.2
Aweme, Manitoba	11.9	2.3	11.1	8
Aweme, Manitoba	13.2	2.9	11.8	9.2
Rapid City, South Dakota	13.9	3	12	9
Rapid City, South Dakota	14.6	3	12.6	9.3
Haigler, Nebraska	12.9	2.6	11	8.4
Haigler, Nebraska	12.2	2.7	12.2	8.5
Hamilton County, Kansas	13.2	2.9	12.6	8.7
Hamilton County, Kansas	14.8	3	13.5	10
Pine Mountain, Texas	14	3	13.2	10
Pine Mountain, Texas	15.2	3.1	14.6	11
Laramie, Wyoming	12.9	2.6	11.9	8.2
Willow Park, Colorado	12.8	2.8	9.2	8.5
Willow Park, Colorado	13.7	2.7	9.4	8.3
Almont, Colorado	13.3	2.6	11.5	8.6
Almont, Colorado	15.2	3	11.5	9.2
Creede, Colorado	13	2.6	9.7	8.2
Creede, Colorado	13.7	3	11.4	9.1
Dark Canyon, Pikes Peak, Colorado.	11.9	2.5	10.8	7.8
Manitou Park, Pikes Peak, Colorado.	12.1	2.3	10.6	8.5
Trinidad, Colorado	12.4	2.5	11	8.3
Trinidad, Colorado	13.2	3	13.1	9.5
Clifton House, New Mexico	11.2	2.5	12	8.9
Clifton House, New Mexico	13	3	11	8.5
Datil Canyon, Datil Mts., New Mexico	13.7	2.2	10.6	8.3
Mesa east of Albuquerque, New Mexico	13.3	2.6	13.5	9.2
Mesa east of Albuquerque, New Mexico	14.3	2.9	14.1	10.2
Alamogordo, New Mexico	13.2	2.8	13.6	9.8
Alamogordo, New Mexico	15	2.9	13.8	11.2
Aden, New Mexico	14.2	3.1	13.9	10.2
Aden, New Mexico	15.2	3	15.4	11.5
Silver City, New Mexico	12.5	2.8	12.3	9.4
Silver City, New Mexico	15.1	3.2	13.8	10.6
Ash Fork, Arizona	11.4	2.5	11.1	8.2
Ash Fork, Arizona	13	2.8	11.2	8.8
Pinery Canyon, Chiricahua Mts., Arizona	12	2.7	12.5	9.5
Pinery Canyon, Chiricahua Mts., Arizona	14.4	3	13.9	10.7

♂	Length of body	Length of pronotum	Length of tegmen	Length of caudal femur
Baboquivari Mts., Arizona	17	3	14.1	10.7
Baboquivari Mts., Arizona	17.2	3.2	16	11.4
Beaver Creek Hills, Utah	13	2.8	13	9.5
Meseta de la Zarca, Durango	15.3	2.7	13.7	10.6
Meseta de la Zarca, Durango	15.5	2.8	15.5	10.6
Atypical *P. delicatula delicatula*				
Grand Junction, Colorado	15.5	3	17.9	9.5
Warner Lake, Oregon	12.5	2.5	12.2	8.6
Warner Lake, Oregon	14.9	3.2	13.7	10.5
Intermediates between *P. delicatula delicatula* and *P. delicatula buckelli*				
Bozeman, Montana	12.6	3	11.9	8.9
Bozeman, Montana	15.4	3.6	14.3	10.7
Worland, Wyoming	13.9	3	12.8	10.2
Worland, Wyoming	15.2	3.2	14	10.8
Stansbury Island, Utah	15.6	3	13.9	10.6
Typical *P. delicatula delicatula*				
♀				
Medicine Hat, Alberta	16	2.9	12.4	8.6
Medicine Hat, Alberta	18	3.2	13.9	9.7
Aweme, Manitoba	18.2	3.3	13.6	10
Aweme, Manitoba	20.8	3.5	14.6	11.2
Rapid City, South Dakota	18.2	3.2	14.2	10.4
Rapid City, South Dakota	19.5	3.5	15.5	10.9
Haigler, Nebraska	15.5	3.2	14.1	9.5
Haigler, Nebraska	18.6	3.6	15.2	10.8
Hamilton County, Kansas	19	3.6	15.9	11.5
Hamilton County, Kansas	20.5	4	16.6	11.8
Pine Mountain, Texas	20	3.5	17.5	13
Pine Mountain, Texas	23.5	3.8	18.5	13.7
Sidney, Montana	18.7	3.9	14.6	10.8
Laramie, Wyoming	17.8	3.5	14.1	10.9
Willow Park, Colorado	16.8	3.1	12.6	10.1
Almont, Colorado	21.8	3.6	13.9	11
Creede, Colorado	17.2	3	11.6	9.8
Creede, Colorado	21	3.5	15.2	11.7
Florissant, Colorado	15.6	3.1	11.4	9
South Park, Colorado	16.6	3	12.2	9.2
Manitou Park, Pikes Peak, Colorado.	15	3	10	8.4
Manitou Park, Pikes Peak, Colorado.	17	3	13.6	10.3
Trinidad, Colorado	17.6	3	13.2	10.5
Trinidad, Colorado	18.8	3.4	15	11

♀	Length of body	Length of pronotum	Length of tegmen	Length of caudal femur
Chicorica Creek, New Mexico	18.3	3.2	13.4	10.5
Chicorica Creek, New Mexico	18.5	3.4	14.6	10.6
Clifton House, New Mexico	17.2	2.9	14.6	10.1
Clifton House, New Mexico	22.8	3.2	16.3	11.9
Tesuque Creek, New Mexico	18.7	3.8	15.6	11
Tesuque Creek, New Mexico	18.8	3.7	15.2	11.5
Mesa east of Albuquerque, New Mexico	21.1	3.7	16.9	13.1
Datil Canyon, Datil Mts., New Mexico	18.6	3	12.7	10.2
Datil Canyon, Datil Mts., New Mexico	22.1	3.6	14.6	11.5
Alamogordo, New Mexico	20.4	3.4	17.5	13.5
Alamogordo, New Mexico	21.5	4.2	19	13.7
Aden, New Mexico	21.2	3.9	18.8	14
Aden, New Mexico	23.4	4.1	20	14.8
Silver City, New Mexico	18.5	3.6	16.2	12.5
Silver City, New Mexico	20.2	3.8	18.5	13.6
Ash Fork, Arizona	21	3.7	16.8	12.3
Pinery Canyon, Chiricahua Mts., Arizona	19.6	3.2	16.2	12.1
Pinery Canyon, Chiricahua Mts., Arizona	22.2	4	18	14
Baboquivari Mts., Arizona	25.4	4	19.5	14.6
Baboquivari Mts., Arizona	25.1	4.3	20.2	16
Beaver Creek Hills, Utah	23.5	3.8	19.4	13.3
Crestline, Nevada	20	3.9	16+[185]	11.6
Silver Canyon Trail, White Mts., California	21.2	3.6	16+[185]	11.7
Meseta de la Zarca, Durango	22.3	3.7	18	13
Meseta de la Zarca, Durango	23.6	4	19.8	14.5
Atypical *P. delicatula delicatula*				
Forsyth, Montana	18.2	3.5	16	10.3
Forsyth, Montana	20	3.7	16	11.1
Grand Junction, Colorado	23.8	4.2	19	13.4
Intermediates between *P. delicatula delicatula* and *P. delicatula buckelli*				
Bozeman, Montana	17	3.4	15	10.9
Bozeman, Montana	20	4.4	19	12
Worland, Wyoming	20	3.6	16.4	11.8
Worland, Wyoming	24	4.2	17.7	12.5
Stansbury Island, Utah	24.7	4.5	19.4	13.1

[185] Tegminal apices broken—apparently a late survivor.

An analysis of the above figures demonstrates that, speaking broadly, individuals of this subspecies respond to the usual rule in increasing in size southward, reaching their maximum size in western Texas, southern New Mexico and Arizona and Durango, Mexico. The usual corollary of reduced size in individuals from montane or at least more elevated areas, in a region where medium or lower levels is the rule, is equally evident. The latter tendency is so pronounced that, as shown above, material from certain elevated Colorado localities (as Dark Canyon, Manitou Park, South Park, Florissant and Willow Park) is as small as or smaller than individuals from the most northern localities from which the species is known.

As a whole the minima are from Medicine Hat, Alberta; Sidney, Montana; Laramie, Wyoming; Haigler, Nebraska; Dark Canyon, Manitou, South Park, Florissant and Willow Park, Colorado; the region adjacent to the Raton Mesa in southern Colorado and northern New Mexico (i.e. Trinidad, Colorado and Chicorica Creek and Clifton House, New Mexico); the Santa Fé Range in northern New Mexico (Tesuque Creek), and Ash Fork, Arizona. The small size of the Alberta, and similarly the Manitoba and eastern Montana, material is, of course, readily understood as a response to the northern character of these regions, and the greatly reduced bulk of the individuals from Willow Park, Florissant, South Park, Manitou Park and Dark Canyon, Colorado, is quite evidently due to the montane character of these localities. The causes which have operated to produce the reduced average size of individuals from certain of the other localities mentioned are not so clearly evident and the stations must be analyzed for possibilities. Laramie, Wyoming is a locality of considerable elevation (7150 feet), in a plains area swept by cold winds from the north; Haigler, Nebraska is in a sand-hill region where a generally unfavorable environment is probably responsible for the otherwise unexpectedly small size; possibly the factor of a volcanic and residual or transported soil, derived from disintegrated basalts or rocks of similar origin, operates on this insect in the same way at Trinidad, Colorado; Clifton House and Chicorica Creek, New Mexico and Ash Fork, Arizona.

In the Creede, Colorado series we find some response to the marked elevation of that locality (8844 feet), but this is by no means as evident as might be expected. On the other hand we see in the case of the Aden and Silver City, New Mexico series direct size response to the somewhat higher elevation of the latter locality (approximately fifteen hundred feet), although the two localities are separated by not more than seventy miles of air-line distance.

The size optimum is apparently reached in the lower grassy plains of southwestern New Mexico and southern Arizona, as evidenced by Aden and Baboquivari Mountains material. Similar cover conditions at higher elevations to the southward in Durango, Mexico (Meseta de la Zarca) apparently produce essentially the same response. This correlation and size response in southern New Mexico and Arizona has been observed by Mr. Hebard and the author in a number of species of Orthoptera occurring in that area. Apparently it is a reaction in species of similar plasticity to factors not clearly understood at this time.

Color Variation.—An analysis of the color features of this species and subspecies show a very definite parallelism to the conditions found in the related *Psoloessa texana,* for a discussion of which I would refer the student to the paper by Rehn and Hebard in which the color types of *texana* were tabulated.[186]

In *Psoloessa texana* we find four well defined pattern types, rarely pure in nature and with the material representing intermediate conditions far outnumbering what may be considered that of the pure or approximately pure lines. The present insect shows four color types, which, while not equivalents to those of *texana,* when pure or practically so are very well defined. However, certain variants or localized patterns quite independent of and in addition to the general one, complicate the situation in many cases. As in *texana* the percentage of apparently pure patterned individuals is relatively low, probably not as low as in that species, but sufficiently so that at least half of the large series now before me is not typical of any one pattern type.

It must be realized that these lines are of pattern and not of mere tonal depth, regarding which a word will be said later. I am fully

[186] Proc. Acad. Nat. Sci. Phila., 1908, pp. 381–383, (1908).

convinced that these pattern types, and their modifications discussed below, are genetic, and will be found directly parallel to those isolated by Nabours in his studies of *Paratettix* and *Apotettix*.[187] The proof or disproof of this assumed parallelism will, of course, require experimental demonstration, but the assumption is clearly warranted and wholly logical.

The major pattern types are:

A. Pattern strongly bicolored with marked and contrasted pale lateral carinae of the pronotal disk; oblique pale dashes on the lateral lobes of the pronotum; inter-carinal portion of pronotal disk dark, paler mesad; tegmina with discoidal field having a regular longitudinal series of dark and light quadrate maculations, the number of which is variable, often on the paired tegmina; anal field of tegmina similarly but more finely quadrate patterned.

B. General color much duller, with little or no contrast of the lateral carinae of the pronotal disk; the oblique pale dashes on the lateral lobes of the pronotum hardly or not at all indicated; tegmina with discoidal field having the dark and light maculations as in type A.

C. General tone pinkish red, the suffusion so general and pronounced in typical material that no indication is seen of pale oblique dashes on the lateral lobes of the pronotum or of pale lateral carinal lines on the disk of the pronotum; tegminal blocking less evident than in types A and B. (This color type in its pronounced or typical condition is always associated with a structural feature, i.e. the partial suppression of the lateral carinae of the pronotal disk, for a discussion of which see page 217.)

D. General base color in life pale greenish or greenish-yellow (light chalcedony yellow to light lumiere green of Ridgway), particularly marked on head, pronotum and caudal femora, dark pattern of same areas pronounced and consequently strongly contrasted.

The partial or minor pattern features may be grouped as follows:

1. Humeral angle of tegmina with a pale longitudinal line, sharply contrasted with the darker tone of the anal and ulnar fields of the same.

2. No pale humeral angle on tegmina, but anal field solidly pale.

3. Pronounced medio-longitudinal pale bar on head and pronotum more evident in male sex.

4. Disk of pronotum caudad with a transverse pale area, which is truncate cephalad and occupies one-half of length of metazonal portion of pronotal disk, very rarely this is contrastingly pale greenish.

5. Dark areas of discoidal field of tegmina longitudinally slurred and combined, producing a longitudinal striping instead of transverse blocking effect.

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[187] Journ. of Genetics, III, pp. 141–170, pl. VI, (1914). Genetica, V, pp. 477–480, plate, (1923). Tech. Bull. 17, Kansas Agr. Exper. Sta., pp. 5–231, pl. I, (1925).

What I have referred to as partial or minor pattern types occur in combination with most all of the major pattern types, with the following exceptions: minor type 1 is most evident in combination with major type A, hardly indicated at all with type C, very weakly so with type D, and rarely occurring in conjunction with type B but well indicated when present; minor type 2 occurs with all major types and sometimes with minor type 3, but the latter as a pronounced condition is more infrequent, and often is entirely lacking when type 2 is quite pronounced; minor type 3 is quite rare in its fully marked condition, and I have seen it only in combination with type A; minor type 4 is also quite unusual and I have seen but four specimens (all females) with it distinctly developed, all of type A and in one case with minor type 2 also marked, but here the tegminal anal field is grayish and not greenish as is the caudal section of the pronotal disk; minor type 5 is rarely well indicated but frequently intimated, generally in combination with type A.

Major type A is by far the more frequent, dominant and generally distributed one, occurring commonly in what may be considered a pure condition, but also in combination with all the minor types. It can hardly be called representative of or characteristic of any one great area, but is less marked and frequent in southern Utah than elsewhere.

Major type B occurs at localities where type A also is present, but apparently is more frequent in series from montane and northern localities. Its most frequent combination with any minor type is with number 1, but we have not seen it with number 4.

Major type C is apparently localized, and I have seen fully typical material only from certain localities in south-central Utah and southern New Mexico and Arizona, although the condition is strongly intimated in series from northern Arizona (Ash Fork) and indicated in part of that from Durango, Mexico (Meseta de la Zarca).

The most distinctly localized of the major types, at least as far as known, is type D, which in its marked condition I have seen only from the Laramie Plains in Wyoming (i.e. Laramie) and in adjacent northern Colorado (Laramie River just below the Colorado line). This is Bruner's *Stirapleura eurotiae*. I would point

out, however, that but a portion of the material from these two localities is of type D, the remainder being of type A. Intimations of D are seen in material from Pine Ridge, South Dakota.

To summarize pattern types it is well to stress again that not more than one-half of the series examined can be segregated into what appear to be typically the major types, with the minor types weaving through these in many ways. The intermediates are of every shade of transition, and I feel fully confident they represent crosses of types which have been tentatively selected and assumed to be the pure lines. Future work and exhaustive breeding experiments will determine whether the assumptions here made are warranted.

The localization of certain types, as C and D, is suggestive and one is tempted to assume an environmental control, which would be most unacceptable to certain other students, but the fact remains that some correlation of these types, when fully marked, with definite areas or localities does exist, although not to the exclusion of other color phases. Unfortunately very little of the material representing these color types was collected by the author or by Hebard and Rehn, so no unpublished habitat notes or personal field observations on these specimens are available.

Turning to the general tone of the coloration as distinct from pattern, and understanding by it a mere deepening or bleaching of the tone as a whole, speaking broadly, there are marked geographic tendencies evident in the series. At the same time in a number of the larger series are distinct exceptions to the relatively uniform tonal depth posesses by most of the individuals in these series. These exceptions, however, are generally representatives of the major color pattern types of a most pronounced character. It would seem that these marked phases possess what might be called greater resistance to the mantling influence responsible for the otherwise general uniform depth of the tone of the series. Whether the factors responsible for this general uniformity are physiological, physical or genetic remains to be determined. Physical bleaching may be an actual factor in certain localities where strong sunlight and a pronouncedly reflecting surface occur. Survival may be a very real factor in the uniformity of the tone at many localities.

The general tone of the pale base coloration ranges from as pale as cream-buff and naples yellow to as dark as snuff brown on the tegmina and limbs, and storm gray (Ridgway, pl. LII) on the ventral half of the head and lateral lobes of the pronotum. In certain material we find a pronounced mantling suffusion of gray buff, sometimes nearly obscuring the more normal pattern of major type A, again acting only as a toning of the pale coloration.

As a whole the more northern material and the truly montane series show a darker tone, with the pattern, particularly in the males, less evident than usual. Material from the sand dune areas of southwestern Nebraska and western Kansas are quite pale, while those from western Texas are exceedingly dull in tone, with pattern little emphasized, but one (a Marathon female) having it really contrasted.

Speaking generally the series from the Trinidad and Raton region of Colorado and New Mexico (i.e. Trinidad and Gray Creek, Colorado; Chicorica Creek and Clifton House, New Mexico) is very dull in general tone, while that from the immediate vicinity of Colorado Springs and the eastern plains of Colorado is as brilliantly contrasted, with as light a base color, as any representative series from eastern Wyoming or eastern New Mexico. The really montane Colorado material is, however, quite dull.

Southern New Mexico shows a marked predominance of buffs and grays in the base tone at Aden and Alamogordo, while the Silver City extensive representation is similarly contrasted but tinted more distinctly rufous. South Arizona material shows appreciable range in the base tone, particularly in the Chiricahua series and as usual more evident in the male sex. The predominating reddish tone (Type C) in material from the Baboquivari Mountains of southern Arizona has already been stressed. The Prescott, Arizona series as a whole has the base tone pale. Utah material collectively has the base tone grayish, except in those individuals of the pronounced stage of type C.

The Worland, Wyoming series, intermediate between *P. d. delicatula* and *P. d. buckelli,* is relatively grayish in base tone, as befits a sage brush environment, while those from Bozeman and Lime Spur, Montana are distinctly darker, although in them the tone

value is gray or gray brown, but appreciably duller and more suffused, thus giving a different ensemble.

Bionomics.—Dry, gravelly, sandy or even stony flats and slopes, areas frequently of very circumscribed extent, and usually with a ghost-like cover of short grass, which is often yellow from sun curing, would be a general characterization of the habitats preferred by *delicatula delicatula.* Occasionally it seems to be partial to an area heavily clothed with tall, relatively rank grass, again it frequents the neighborhood of patches of sweet sage (*Eurotia lanata*), on which it is known to feed, and it has been noted a number of times on perfectly bare ground. Where an arborescent or herbaceous growth is present in its preferred habitat, this may be of mesquite (*Prosopis*), often sage (*Artemisia*), occasionally juniper and pinyon, which two are generally found associated, or rarely narrow-leafed yucca. These associations are, of course, governed by the biotic position of the individual locality. While we may find this form on a level plain with thin short grass and scattered low mesquite bush cover, as at Aden, New Mexico, we will also take it on the benches and slopes of Raton Mesa in short grass and yellow flowered composites under juniper and pinyon at Trinidad[188] and Gray Creek, Colorado.[189] Again its general adaptability is such that at a single locality (Aden, New Mexico) it was secured in three distinct habitats: i.e. a plain with low grass and scattered mesquite bushes, a limited area of much heavier grasses, some nearly a foot high, and the rocky slopes of a low hill with a scattered growth of creosote bush (*Covillea*).

In actions typical *delicatula* is quite rapid, although less so than its smaller and more elusive congener *texana.* When not seriously frightened it frequently will crouch and refuse to fly, or jump, particularly the females, but when thoroughly aroused both sexes launch into vigorous flight.

The dull or cryptically colored specimens are often amazingly protected by their non-descript pattern, but others, representing the more boldly lined and contrastingly blotched phases, are frequently by no means hidden when in their natural environment. It is quite

[188] Las Animas County; VII, 23–25, 1919; (R. & H.); 23 ♂, 9 ♀ [A.N.S.P. and Hebard Cln.].

[189] Las Animas County, up to 7000 feet elev.; VII, 24, 1919; (R. & H.); 6 ♂, 8 ♀; [A.N.S.P. and Hebard Cln.].

probable, however, that under many conditions of nature these bold patterns act as a camoulflage and become distinctly obliterative. While from my own experience I cannot definitely make such a statement as fact in connection with the present genus, I do know from personal observation it is true in relation to the genera *Acrocara, Phrynotettix* and a number of others.

A form of spring and early summer occurrence, by midsummer this insect has disappeared in the adult condition over a considerable portion of its extensive range, although the immature stages become evident again in August and have been taken as late as early October (Navajo Point, Arizona[190]). The latter evidence, taken with the very early occurrence of adult individuals in the spring, would indicate that the winter is passed in the nymphal condition, as we know is the case with *P. delicatula buckelli.* The earliest date known for the adult is March 26 (Colorado Springs, Colorado[191]), the latest, September 10 (Silver Canyon Trail, White Mountains, California). The information before me shows that while this subspecies becomes adult quite early in the northern portion of its range, its season is shorter there than to the southward, where as a mature insect it occurs as late as September (Northern New Mexico; Crestline, Nevada; Silver Canyon Trail, California).

Within its limited Canadian range *delicatula delicatula* occurs adult as early as May 6 (Lethbridge, Alberta) and as late as July 29 (Aweme, Manitoba). In the northern portion of its range within the United States the earliest dates by states are May 7 (Huntley, Montana[192]), April 20 (Worland, Wyoming[193]) and April 23 (South Dakota ex Hebard), while the latest dates for the same areas are August 20 (Bozeman, Montana[194]), July 31

[190] Grand Canyon, Coconino County; X, 4, 1919; (H.); 1 juv. ♂, 4 juv. ♀; [Hebard Cln.].

[191] El Paso County; III, 26, 1916; (H. B. Baker); 1 ♀ [A.N.S.P.].

[192] Yellowstone County; V, 7, 1914; 2 ♀; [A.N.S.P.].

[193] Big Horn County; IV, 20–30, 1911; (L. Bruner); 11 ♂, 22 ♀; [Hebard Cln.]. These individuals are intermediate between *P. d. delicatula* and *P. d. buckelli.*

[194] Gallatin County, 4800 feet elev.; VIII, 20, 1911; 1 ♀; [A.N.S.P.]. This and all the others of an extensive series from this locality are intermediate between *P. d. delicatula* and *P. d. buckelli.*

(Cheyenne, Wyoming[195]) and an unspecified date in August (Custer, South Dakota[196]). In Colorado the season begins to lengthen appreciably, March 30 (Colorado Springs) and August 5 (Antonito[197]) being the extremes; Nebraska material gives a definite range from some time in May (Sioux County[198]) to July 14 (Alliance[199]); Kansas from May (Clark County[200]) to July 18 (Haskell County[201]). In northern New Mexico we find this insect adult as early as April 8 at Las Vegas,[202], common there by April 12 (Scudder and Cockerell), and occurring as late as September ("Northern New Mexico"), while in southern New Mexico dates of April 14 (Alamogordo) and August 30 (Organ Mountains ex Scudder and Cockerell) give a very similar seasonal range, or a period of over four months in New Mexico as a whole. In Texas it is known to occur from June 26 (Sierra Blanca[203]) to August 29 (Pine Mountain). At a number of southern Arizona localities it has been taken in April, as early as the 11th in the Baboquivari Mountains. In Pinery Canyon in the Chiricahua Mountains of southeastern Arizona adults of *d. delicatula* were taken from May 22 to July 15, and would probably have been encountered later if work then had been possible, while in northern and central Arizona it was secured adult as early as May 16 (Bright Angel[204]) and as late as August 16 (Mt. Union[205]).

Immature individuals in the series before me were taken as early as March 9 and as late as June 26 at Fort Wingate, New Mexico. Similar conditions are represented by material taken August 18 at Lee Canyon, Spring Mountains, Nevada, seen September 10 on Silver Canyon Trail, White Mountains, California,

[195] Laramie County, 6100 feet elev.; VII, 31, 1910; (R. & H.); 1♀; [Hebard Cln.].
[196] Black Hills, VIII, 1888; 1♀; [Hebard Cln.].
[197] Conejos County; VIII, 5, 1900; 2♂; [A.N.S.P.].
[198] V; 1♀; [Hebard Cln.].
[199] Boxbutte County, 4000 feet elev.; VII, 14, 1909; (R.); 1♀; [Hebard Cln.].
[200] 1962 feet elev.; V; (F. H. Snow); 1♂, 1♀; [Univ. of Kansas.].
[201] 2700 feet elev.; VII, 18, 1911; (F. X. Williams); 2♀; [Univ. of Kansas].
[202] San Miguel County; IV, 8, 1901; (Cockerell); 1♀; [M.C.Z.].
[203] Type of *Stirapleura tenuicarina* Scudder.
[204] Grand Canyon, Coconino County; VI, 16, 1921; (C. D. Duncan); 1♂; [Cal. Acad. Sci.].
[205] Yavapai County; VIII, 15, 1917; (J. A. Kusche); 1♂; [Hebard Cln.].

and taken September 13 (Wassuk Range, Nevada) and 18 (Wells and foothills of Ruby Mountains, Nevada), and October 4 (Navajo Point, Arizona). The exact subspecific relationship of this Nevada immature material cannot be determined.

There exists a possibility that in a portion of its range *delicatula delicatula* may be two-brooded, but the data are not sufficiently conclusive to warrant the assumption that such is the case. The late occurrence of adults at certain localities appears to me to be more readily explained as that of the last stragglers of the spring and early summer brood, rather than representatives of a second late summer brood. In my own experience I have never seen this insect adult in numbers late in the season except on the slopes of Pine Mountain, western Texas, where on August 29 it was plentiful. That station, however, was at a considerable elevation (6600 feet) and this late occurrence is quite in line with the evidence presented by single individuals or very small series from other elevated localities in the southwestern United States, apparently showing a retarded development at these elevations. At more northern localities of even approximately similar altitudes early frosts would have removed individuals whose maturity was similarly belated.

THE DERMAPTERA AND ORTHOPTEROUS FAMILIES BLATTIDAE, MANTIDAE AND PHASMIDAE OF TEXAS

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(Plates XII and XIII)

In 1934 first steps were taken toward a comprehensive study of the Dermaptera and Orthoptera of Texas. During the following four years, while other work continued, all unstudied Texan collections available were requested and as received were sorted along with the very large series already belonging to the Philadelphia collections. Subsequently a long period of acute illness intervened and only recently have I been able to finish the necessary studies for the portions here presented.

The advisability of such a study was indicated by the need to bring to a focus the results of my sequence of studies in this subject for the prairies and Great Plains which had appeared as follows: Illinois (Key and figures) 1934, Minnesota (Key) 1933 and 1936 notes, North Dakota (Key) 1936, South Dakota 1925 and 1936 notes, Kansas 1931, Oklahoma (partial, based on a collection made for an economic report) 1938, Alberta 1931, Montana 1928 and 1932 notes, Colorado 1929 and 1933 notes, and New Mexico (but covering only the upper Rio Grande region) 1935. The other pertinent States are not yet covered as I have felt that additional material from them is still needed. Wyoming is different, much material from that State showing an exceptional extension eastward of Great Basin influences. Detailed consideration of the Orthoptera of the varied and in general much less well known regions west of the Rocky Mountains is advisable before a satisfactory report on Wyoming can be made. A full report on Okla-

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homa is highly pertinent to the present work and is, of course, greatly needed, but Dr. T. H. Hubbell is at present assembling the data for such, having already published a list with many records for that State.

The most important collections were assembled by Mr. James A. G. Rehn and the Author during their field work in all parts of Texas and are now at the Academy of Natural Sciences of Philadelphia, either belonging to that Institution or to the Author's collection deposited there. To these have been added the very large collections belonging to the Texas Agricultural Experiment Station, the United States National Museum (that portion assembled by E. V. Walter at San Antonio, Texas, being particularly valuable), to Dr. F. B. Isely at Waxahachie, Texas, to the University of Kansas and the Illinois State Laboratory of Natural History. Many other Institutions and individuals have given me valuable assistance, particularly the University of Michigan, the Museum of Comparative Zoology, Southern Methodist University, Cornell University and the Ohio State Museum, and to all I wish to express my heartiest thanks but my gratitude is especially deserved by Miss Mary B. Chubb, without whose unfailing cooperation I could not have completed this task.

To my records have been added by Dr. T. H. Hubbell those based on the specimens at the Museum of Zoology of the University of Michigan, all such records being designated by an asterisk. He has not only added important data, but has also furnished the sections to the key necessitated by the addition of several species not otherwise known from Texas.

The material belongs to the various Institutions as here indicated by the various collectors unless otherwise noted. United States National Museum; H. S. Barber, F. C. Bishop, G. H. Harris, W. E. Hinds, W. A. Hooker, W. D. Pierce, F. C. Pratt, L. Seaton, S. W. Thuron, E. S. Tucker, E. V. Walter. Texas Agricultural Experiment Station; F. F. Bibby, C. E. Heard, F. M. Hull, H. B. Mills, W. C. O'Dowd, H. J. Reinhard. Hebard Collection; L. Bruner, C. A. Hart (in part), M. Hebard, F. B. Isely, M. Newell, H. B. Parks, O. C. Poling, H. R. Roberts, B. Thaw

Jr., E. R. Tinkham, A. Wadgymar, G. O. Wiley (in part). University of Kansas; L. D. Beamer, R. H. Beamer, G. Dorner, J. G. Shaw, F. H. Snow, G. O. Wiley (in part). Academy of Natural Sciences of Philadelphia; J. N. Knull, J. A. G. Rehn, H. A. Wenzel. Museum of Zoology, University of Michigan; L. J. Bottimer, R. D. Camp, I. J. Cantrall, F. M. Gaige, Mrs. L. K Gloyd, T. H. Hubbell, J. K. G. Silvey, Crystal Thompson.

The number of species and races now known from Texas and the number of specimens here recorded for the first time give the following totals.

	Species	Races	Adventives	Total	Number of previously unrecorded specimens
Dermaptera	6	0	4	10	272
Orthoptera					
Blattidae	24	0	7	31	696
Mantidae	9	0	0	9	568
Phasmidae	12	1	0	13	1150
	51	1	11	63	2686

In preparing the present publication it has been found advisable to study all available material of each species from all parts of its range, verifying or establishing synonymy and defining limits of distribution or at least those limits newly ascertained as well as those which are least easily located in the literature. This work required decidedly more time than did the assembling of the data for Texas, but has led to a much better understanding of the species involved than would otherwise have been possible.

The keys are for the species of Texas only. They should enable the student to distinguish these species but would be of little value or actually misleading if employed when studying collections from other portions of the United States or of Mexico. Parentheses in these keys are used exclusively to set apart features useful in recognizing the species in question, but which have no alternates, and in consequence do not appear in the alternate sections of the keys.

The data for each species or race is arranged in the following order;

Name.

Original reference.

Best subsequent reference (more than one, only when important additional data has elsewhere been published) and reference to each synonym here first established.

Previous records from Texas giving author and date and including incorrect determinations.

Previously unreported material from Texas (in detail only where few in number or where little had hitherto been published on the species or race in question).

Brief notes on structure or habits.[1]

Part or all (if hitherto poorly understood) limits of known distribution.

The State of Texas includes a number of regions of very distinct flora and fauna, of which the eight following are the most striking from an Orthopterological point of view. (With the publication of the sections of my studies which include the Tetrigidae, Acrididae, Tettigoniidae, Gryllacrididae, Gryllidae and Gryllotalpidae, I expect to publish maps indicating the location of the multitude of places at which material has been secured.)

1. This is the humid and comparatively narrow strip along the eastern border of Texas. It limits the extent westward of the lofty swamp forests and open pine flatwoods of the southeastern United States.

2. A decidedly wider area of gradual change, but often of much local diversity, between the humid east and the dry west. It is characterized by extensive patches of low deciduous woods, open rich soil bottom-lands and prairies. There are also in the northern portion open areas of limestone outcrop, where conditions exist nearest to those of the Great Plains.

3. The Central Region of the southern Great Plains, gradually becoming more dotted with Mesquite and brush areas known as "bosque." It reaches west to the Edwards Plateau and south to the Brownsville Region.

4. The Pan-Handle, which is (*a*) typical high Great Plains intersected by (*b*) very deep river canyons. To the south on the Edwards Plateau, the plains give way to (*c*) a southern and definitely semi-arid southwestern flora and fauna.

[1] Full data on variation, response to environment, and habits are not advisable in a study of the present character.

5. A very narrow coastal strip of sand beaches and salt marshes, changing gradually from (*a*) southern and almost subtropical (in East) to (*b*) tropical (on the Mexican border).

6. The Brownsville Region. This includes semi-arid lowlands showing as strongly a tropical influence as adjacent Tamaulipas. It is distinguished particularly in its limited southern portions by heavy tropical tangles in which Texas Palmettos are conspicuous, these mainly present in the dry river beds known as "resacas." Here and on the coast are found the northern and eastern limits of a number of species more widely distributed in the lowlands of northeastern Mexico.

7. The area extending northwest from the Brownsville Region along the Rio Grande to the Pecos River, and north to the Edwards Plateau. A number of interesting Orthoptera occur here which elsewhere are as yet known only from adjacent Mexico between the coast and the mountains to the west.

8. The Western Region known as Trans-Pecos Texas. A region of considerable elevation, which includes (*a*) adobe flats called "playas," wide arid valleys, hills and (*b*) mountain ranges. Of the latter the Guadalupe, Davis and Chisos Mountains are forested and are the most distinctive, while the Franklin and the Chinati Mountains are much like the treeless semi-desert ranges of our Southwest. The fauna of the region is southwestern, the Chinati and Chisos Mountains showing the strongest percentage of southern species which are more extensively distributed in the high country and mountains of adjacent northeastern Mexico.

DERMAPTERA

Texas has a considerably larger representation of Dermaptera than any other State except Florida, the ten entities here discussed equalling two-thirds of those of this comparatively small Order that are known from the United States.

Only five of the species here considered are definitely natives. The other five have been widely distributed by commerce, of which at least three are almost certain adventives.

Of the native species one occurs over all but the northern and western portions of the State. Two, of which one has as yet not been taken in Texas but is almost certainly present, are probably

confined to the humid eastern area. One is present in the Brownsville Region and northwestward some distance along the Rio Grande. One is limited to the driest and warmest southern parts of the area west of the Pecos River, where it is the only species of native Dermaptera present.

Key to the Dermaptera of Texas

1. Body terminated caudad in a pair of forceps (these usually much more simple, straight and attingent in females. Form moderately slender and depressed.) ..... Dermaptera. 2
   Body not terminated caudad in a pair of forceps.
   Orthoptera (Key on page 251)
2. Second tarsal segment cylindrical 3
   Second tarsal segment strongly dilated, heart-shaped. (Coloration brown, tegmina and wings with a broad meso-lateral longitudinal band of yellow. Male pygidium armed with a spine. Male forceps moderately divergent, then curved moderately inward and downward to the horizontal sub-attingent distal portion, armed with an internal apical tooth. Forficulidae. Forficulinae 10
3. Antennae with many (14 to 30) segments, the fourth to sixth inclusive shorter than the first. Labiduridae 4
   Antennae with fewer (10 to 16) segments, the fourth to sixth inclusive longer than the first. Labiidae 6
4. Metasternum with caudal margin convex. Apterous. Body coloration dark brown. Psalinae 5
   Metasternum with caudal margin truncate. Tegmina and wings present. Body coloration varied, light browns and buffy. Labidurinae. (The largest Texan earwig. Ultimate tergite of male with a pair of projecting blunt teeth mesad on its caudal margin. Pygidium vertical, not visible from above. Male forceps moderately incurved, with a small median or post-median internal tooth. Under litter on sea beaches and in similar environment up rivers.)
   3. *Labidura riparia* (Pallas)
5. Antennae with more (usually around 20) segments. Antennae and limbs not annulate. Size medium large. Male forceps with a blunt proximo-internal projection, distad strongly curved inward. (Under litter on sea beaches.) ..... 1. *Anisolabis maritima* (Géné)
   Antennae with fewer (14 to 16) segments. Antennae with a pale annulus distad and femora usually with a suffused dark annulus mesad. Size small. Male forceps without a proximo-internal projection, distad strongly curved inward. (Under litter almost anywhere.)
   2. *Euborellia annulipes* (Lucas)
6. Size medium. Dorsal surface of head flat. (Color deep red-brown with exposed portions of wings yellow. Antennae with 14 to 16 joints, the distal joints elongate, cylindrical.) Spongiphorinae 7
   Size smaller. Dorsal surface of head moderately convex. Labiinae 8

7. Eye large, longer than cheek. Male pygidium produced, its lateral margins divergent, then concave-convergent to the narrowly truncate apex. Male forceps with a small (rarely almost obsolete) meso-proximal internal tooth. Under bark of dead trees in forest.
4. *Vostox brunneipennis* (Serville)

Eye smaller, shorter than cheek. Male pygidium produced, its lateral margins weakly convergent to disto-lateral points between which the broad distal margin is shallowly concave. Male forceps with a small subapical internal tooth. In decaying cacti of arid regions.
5. *Spongovostox apicedentatus* (Caudell)

8. Size very small, smallest of the Texas earwigs. Body pubescent. Coloration light browns, the terminal antennal joints palest. Fourth antennal joint cylindrical, the succeeding joints only slightly thicker distad than proximad. Male pygidium hemicylindrical; subgenital plate produced in an elongate, straight, slender, blunt process. (Antennae with 10 to 12 segments. Tegmina and wings fully developed. Male forceps moderately incurved, with a small proximo-internal tooth followed by a series of still smaller teeth. Generally in manure piles, compost, etc. Introduced.).....6. *Labia minor* (Linnaeus)

Size somewhat larger. Body glabrous. Coloration brown tinged with reddish. Fourth and succeeding antennal joints bead-like or pyriform. Male pygidium roughly quadrate, the distal margin interrupted by four points; subgenital plate without median process.....9

9. Size small, form moderately slender. Fourth and succeeding antennal joints bead-like. Tegmina present; wings present or vestigial and concealed; when present with exposed portions yellow. Male forceps moderately incurved with a meso-proximal and a meso-distal (rarely obsolete) minute, internal tooth, between which teeth the internal margin shows stronger concavity. Rarely greasy. Under bark of dead trees in forests of humid area....7. *Prolabia pulchella* (Serville)

Size slightly larger, form more robust. Fourth and succeeding antennal joints strongly pyriform. Tegmina present, wings vestigial and concealed. Male forceps moderately incurved with a minute meso-distal internal tooth. Always greasy. Domiciliary. Introduced.
8. *Prolabia arachidis* (Yersin)

10. Tegmina and wings fully developed. Male pygidium with an elongate spine. Male forceps with distinctive contour less pronounced and distal portions slightly heavier. Probably in subtropical grasses.
9. *Doru lineare* (Eschscholtz)

Tegmina present, wings vestigial and concealed. Male pygidium with spine even more elongate. Male forceps with distinctive contour more pronounced and distal portions slightly more delicate. In humid temperate grasses.....10. *Doru aculeatum aculeatum* (Scudder)

Labiduridae

psalinae

Anisolabis maritima (Géné).

1832. *Forficula martima* Géné, Sagg. Monogr. Forfic., Indig., p. 9. [Nice, France; Genoa and Tuscany, Italy; along Mediterranean.]
1917. *Anisolabis maritima* Hebard, Ent. News, xxviii, p. 312.

The author recorded material from Virginia Point in 1917, which he found under boards and litter on low grasses on a raised beach.

Galveston, III, 17, 1908, (E. S. Tucker), 1 ♂, 1 juv. ♀. Corpus Christi, (W. D. Pierce), V, 2, 1912, 1 juv., and VI, 6, 1912, 1 ♂.

This large earwig, which has been widely distributed by commerce, was in this manner probably brought to the United States. It is now very likely generally distributed on the beaches of the Gulf Coast of Texas.

Euborellia annulipes (Lucas).

1845. *Forficesila annulipes* Lucas, Bull. Soc. Ent. France, (2), v, p. lxxxiv. [Jardin des Plantes, Paris; probably introduced from North America.[2]]
1917. *Euborellia annulipes* Hebard, Ent. News, xxviii, p. 312.

This insect has been reported from Texas as *Anisolabis maritima* from the Brazos River bottoms near College Station by Hart in 1906, and correctly by me from Alvin and Laredo (where it was found in a drug-store) in 1917.

Tarrant County, 1931, (J. K. G. Silvey), 1 ♂. Galveston, I, 4, 1906, (C. A. Hart; on outer shore), 1 ♀, (pallid, pale antennal annuli obsolete, femoral dark annuli very weak). Colorado County, V, 12, 1922, (G. O. Wiley), 1 juv. ♀. Quincy, V, 12, 1905, (W. A. Hooker), 1 ♀. Austin, 1 juv. ♀. San Antonio, VI, 23, 1931, (Mrs. L. K. Gloyd), 1 juv. ♀.

This abundant species has been very widely distributed by commerce, but is known to be confined to warmer regions than the preceding. My Kansas records, as noted in 1934, indicate local

[2] The original describer was correct in stating that the insect was an introduction at the type locality, Paris, France (though it is established in the southern portion of that country), but incorrect as to probable source (tropical Old World) as shown by present knowledge of the distribution of *annulipes* and its nearest relatives.

and possibly only temporary establishment there. Though usually more frequent in maritime environment, it has penetrated inland in Texas as far north as Tarrant County, Quincy, Austin and San Antonio, the latter locality moreover a western limit in the regions here under consideration, although the species is also widely distributed on our Pacific coast.

LABIDURINAE

Labidura riparia (Pallas) (Pl. XI, figs. 1, 2.)

1773. *Forficula riparia* Pallas, Reise Russischen Reichs, II, Buch 2, Anhang, p. 727.

1917. *Labidura bidens* Hebard, Ent. News, XXVIII, p. 313.

Though I had used the name *bidens* in 1917, I became convinced later that year that the American condition to which *bidens* applies could be considered nothing more than a variant of *riparia*. This has hitherto remained unpublished, though subsequent American material has all been recorded by me as *riparia* without comment.

A series from India studied by me in 1923 [3] offered convincing evidence that this is a very plastic species, dividing into a number of variants, some of which are even more distinctive than that found in America. The differences noted are, however, all too unstable to warrant recognition of geographic races.

Scudder first reported this species from Texas in 1876 and I recorded material as *bidens* from Galveston and Alvin in 1917.

Nineteen ♂, 13 ♀, taken IV, 11 to XI, 16, and 5 immature individuals are before me from Smith Point, Victoria, Corpus Christi, Raymondville,* Point Isabel (on sea beach), Brownsville, three miles southeast of Rio Grande City, Brownwood, Lapara, Del Rio,* and Devils River.

This very large earwig, like *Anisolabis maritima,* prefers sea beaches and has been widely distributed by commerce. Though probably much more abundant along the Gulf Coast than elsewhere, it occurs far inland in Texas. Northern known limits are Galveston, Brownwood and Devils River, the latter being a western limit in the United States as well.

[3] Mem. Dept. Agr. India, Ent. Ser., VII, p. 207.

LABIIDAE

SPONGIPHORINAE

Vostox brunneipennis (Serville)

1839. *Psalidophora brunneipennis* Serville, Hist. Nat. Ins., Orth., p. 30. [Philadelphia, Pennsylvania.[4]]
1917. *Vostox brunneipennis* Hebard, Ent. News, XXVIII, p. 314.

Thirteen ♂, 19 ♀, taken I, 17 to XII, 17, and 4 immature individuals are from Paris, Hetty, Dallas, Austin,* Victoria and Brownsville (from under bark of dead willow). Of these a male and two females from Brownsville are macropterous.

This interesting species has been recorded from Texas as far north as Paris and as far west as Dallas, Austin and Brownsville. My northernmost material is an immature from Posey County, Indiana, taken April 9, 1901, by W. S. Blatchley, which author recorded the species from central Indiana in 1920.

Spongovostox apicedentatus (Caudell)

1905. *Spongophora apicedentata* Caudell, Proc. U. S. Nat. Mus., XXVIII, p. 461, fig. 1a. [♂, ♀: Catalina Springs, Tucson (type locality) and Fort Yuma, Arizona; Los Angeles and San Diego, California.[5].]

Chisos Mountains, VII, 11, 1924, (H. A. Wenzel), 1 ♀, 2 juvs., [A.N.S.P. and Hebard Clns.].

The above is a northeastern limital point in the distribution of this southwestern species which prefers a semi-desert environment. It will probably be found only in extreme southwestern Texas.

LABIINAE

Labia minor (Linnaeus)

1758. *Forficula minor* Linnaeus, Syst. Nat., Ed. X, I, p. 423. [Europe.]
1917. *Labia minor* Hebard, Ent. News, XXVIII, p. 316.

Plano, VIII, (E. S. Tucker), 1 ♀. Dallas, X, 4, 1906, (R. A. Cushman), 1 ♀. Kerrville, 1906, (F. C. Pratt), 1 ♂, 1 ♀.

[4] Probably sent from, but not taken at, this locality. The northernmost material I have seen from the Atlantic Coast comes from Southern Pines, North Carolina. See evidence to indicate further that *brunneipennis* does not occur in New Jersey (H. Fox, State of New Jersey, Dept. of Agr., Circular 138, p. 19, (1928)), though it has been recorded (probably in error) from that State.

[5] Caudell's Columbia, Texas record was based on immature material of *Vostox brunneipennis*, as was that from Point Isabel, Texas.

These are southernmost records for this tiny earwig which, introduced from Europe, is now very widely distributed in the United States and is possibly present throughout Texas.

Prolabia pulchella (Serville)

1839. *Forficula pulchella* Serville, Hist. Nat. Ins., Orth., p. 42. [Niagara, New York (mislabeled or adventive at that locality).]
1917. *Prolabia pulchella* Hebard, Ent. News, XXVIII, p. 319.

Scudder in 1876 described the synonyms *Labia guttata* from [probably Bosque County] Texas and *Labia melancholica* from Waco, Texas.

A large series from Houston (of which part is in the author's collection) was reported by Hart in 1906, the brachypterous individuals as the synonym *Labia burgessi* Scudder, the macropterous as *guttata,* while Burr in 1910 (due probably to lack of males for comparison) incorrectly referred all the macropterous specimens from the United States at the National Museum to the very distinct and peculiarly West Indian *Prolabia unidentata* (Beauvois) and a brachypterous specimen from Willis, Texas, to *burgessi.*

Jacksonville, X, 10 to 12, 1905, 1 ♂, 2 ♀, (brachypterous), 1907, 1 juv. [U.S.N.M.].

Jacksonville and Bosque County are northern limits, the latter and Waco western limits, for this small and beautiful earwig, which is widely distributed through the forests of the southeastern United States and is known from a single locality in western Cuba.

Prolabia arachidis (Yersin)

1860. *Forficula arachidis* Yersin, Ann. Soc. Ent. France, (3), VIII, p. 509, pl. X, figs. 33 to 35. [[Adventive at] Marseilles, France.]
1917. *Prolabia arachidis* Hebard, Ent. News, XXVIII, p. 320.

A specimen from Brownsville was recorded by the author in 1917.

Point Isabel, XII, 11, 1910, (in house), 1 ♀, [Hebard Cln.].

This disgusting greasy household pest of the subtropical and tropical regions has been carried around the world by commerce. In Texas it may occur everywhere along the Gulf Coast, though it is as yet known only from the Brownsville region.

Forficulidae

forficulinae

Doru lineare (Eschscholtz)

1827. *Forficula linearis* Eschscholtz, Entomogr., p. 81. [Santa Catharina, Brazil.]

1914. *Doru lineare* Rehn and Hebard, Jour. N. Y. Ent. Soc., xxii, p. 90, figs. 1 to 4.

Scudder described the synonym *Forficula exilis* from Texas in 1876 and Rehn and Hebard recorded material correctly in 1914 from Brownsville and the nearby Piper Plantation.

Orange, VIII, 14, 1935, (T. H. Hubbell; at light), 1 ♂, (probably an introduction). Brownsville, IV, VII, 19 and XI, 25 and 29, 1908 to 1911, (several from corn in field), 3 ♂, 4 ♀ and 5 juvs. during the entire period, [Ill. State and Hebard Clns.]; VII, 25 to VI, 1, 1934, (J. N. Knull), 1 ♂, 2 ♀; II, 14, 1936, (L. Giovannoli), 1 ♀.* Cameron County, VIII, 3, 1908, (Beamer, Shaw and James), 7 ♂, 9 ♀. Alamo, Hidalgo County, VII, 31, 1921, (C. D. Duncan), 1 ♀, [Cal. Acad. Sci.]. Mercedes, VII, 29, 1921, (L. J. Bottimer; on cotton plants), 4 ♂, 3 ♀.* McAllen, VII, 9, 1921, (L. J. Bottimer), 1 ♂.* Hildalgo County, VII, 23 to VIII, 2, 1928, (Beamer, Shaw and James), 50 ♂, 82 ♀. Del Rio, II, 1, 1907, (F. C. Pratt), 1 ♂; XI, 11, 1933, (E. V. Walter; under leaf sheath of corn stalk in bottom land), 1 ♀. Devils River, VI, 6, 1907, (F. C. Bishopp), 1 ♂, 1 ♀.

Brownsville and Devils River are northeastern limits for this species which occurs throughout the American tropics and is often found in great numbers. It is, unlike the native Labiinae, an insect which lives in the sheaths of herbaceous plants, preferring grasses, corn, etc.

As the eastern *Doru aculeatum aculeatum* (Scudder) is known westward as far as West Point and Peru, Nebraska, and Morgan City, Louisiana, I believe that it will be found in the narrow humid strip of extreme eastern Texas.

ORTHOPTERA

Key to the Families of Orthoptera of Texas

1. Caudal limbs not specialized for leaping.....2
   Caudal limbs specialized for leaping with caudal femora enlarged.....4
2. Cephalic limbs not specialized for grasping.....3
   Cephalic limbs highly specialized for grasping.
   II. Mantidae (Key on page 277)
3. Body strongly depressed, broad, more or less oval in dorsal aspect.
   I. Blattidae (Key on page 252)
   Body elongate and slender.....III. Phasmidae (Key on page 289)
4. (Antennae much shorter than body and relatively heavy.) Auditory organs latero-proximad on abdomen. Stridulating organ of male, when present, on caudal femur and adjacent portion of tegmen. Ovipositor composed of two pairs of short stout processes, with tips acute and usually curved, the dorsal pair curved dorsad, the ventral pair curved ventrad.....5
   Auditory organs, when present, proximad on cephalic tibiae. Stridulating organ of male, when present, in anal fields of tegmina. Ovipositor of various types, but none like the alternate.....6
5. Pronotum covering all or nearly all of abdomen. Cephalic and median tarsi with two joints, caudal tarsi with three joints. Pulvilli absent. Size very small.....IV. Tetrigidae
   Pronotum of normal size, comparatively short, not reaching to base of abdomen. Tarsi with three joints. Pulvilli present. Size very small to very large.....V. Acrididae
6. (Antennae extremely slender and much longer than body.) Tarsi with four joints (but cephalic or cephalic and caudal tarsi with three joints in certain Gryllacrididae, due to atrophy). Tegmina, when present, sloping at sides of body, with much smaller deplanate dorsal section including only anal fields. Ovipositor always exserted, forming a vertically flattened blade or tube which is never enlarged at its apex.....7
   Tarsi with three joints. Tegmina, when present, horizontal in greater portion, the lateral marginal portions alone bent downward (but generally convex in *Tridactylus*).....8
7. Organs of flight fully developed, variously reduced or vestigial but appearance never Grylloid. Many species green, others variously colored.
   VI. Tettigoniidae
   Organs of flight absent.[6] All Texan species brown or buff and glabrous.
   VII. Gryllacrididae
8. Cephalic limbs not specialized for digging. Ovipositor exserted (except in *Anurogryllus* in which it is present but not visible, due to atrophy) forming a very slender cylindrical tube with apex enlarged (except in

[6] In the Gryllacrididae possessing organs of flight, none of which occur in Texas, the tegminal venation is of a primitive character and distinctive, the wings cycloidal.

Trigonidiinae). Antennae extremely slender and much longer than body. Tarsi with three joints. Tegmina, when present, with extensive deplanate dorsal section, the lateral marginal portions alone bent downward (this feature much more striking in some species than in others and always most pronounced in the male). Body often somewhat depressed and broader.....VIII. Gryllidae

Cephalic limbs highly specialized for digging. Ovipositor absent. Antennae less slender and much shorter than body. Tarsi with three or less joints. Tegmina curving more generally to embrace body. Body elongate cylindrical.....IX. Gryllotalpidae

Blattidae

Of the 31 species of this family undoubtedly present in Texas, 11 are eastern and occur in the eastern portion of the State, 2 of these being strictly southeastern and confined to the southern section. Seven are Mexican, of which 4 have a central distribution and 3 are confined to the Brownsville Region. One is endemic in central Texas. Four are southwestern and include the only species known to be native in trans-Pecos western Texas.

Eight are established introductions, 5 of these being of tropical origin. The mildness of the climate of the Gulf Coast of Texas affords a much more favorable area for tropical species, more readily and in some cases often, carried by commerce, to become established than when these are accidentally brought to more northern ports. Such are *Symploce hospes* (Perkins) (of which *S. lita* Hebard is a synonym), *Leurolestes pallidus* (Brunner) and *Holocompsa nitidula* (Fabricius), while *Neostylopyga rhombifolia* (Stoll) and *Holocompsa azteca* (Saussure) may be introduced direct from Mexico and become established in the border towns.

1. Ventral margins of femora armed with numerous spines.....2
   Ventral margins of some or all of the femora unarmed.....22
2. Ventro-cephalic margin of cephalic femora armed with a row of heavy proximal spines, succeeded by a row of more slender shorter distal spines (type B). (Arolia present).....3
   Ventro-cephalic margin of cephalic femora armed with a row of spines which gradually decrease in size and length distad (type A).....15
3. Fourth caudal tarsal joint alone bearing a pulvillus. Tegmina with oblique discoidal sectors (when these are not obliterated by tegminal reduction). Ulnar vein of wing without proximal incomplete branches. (Dorsal surface of male abdomen not specialized. Ventro-cephalic margin of cephalic femora with two distal spines heavier and longer than the others. Size small.).....4

Four caudal tarsal joints each bearing a pulvillus. Tegmina with weakly radiating discoidal sectors and ulnar vein of wing with incomplete branches (when not obliterated by reduction). Organs of flight fully developed in male; similar, to reduced, to vestigial in female.....5

4. Tegmina fully developed in male, considerably reduced but not truncate distad in female. Male subgenital plate with two very small rounded styles which are slightly longer than broad. Generally shining brown; pronotum dark, margined cephalad and laterad with buffy, which band at the latero-caudal angles crosses the pronotum before the caudal margin and in this portion is broader than elsewhere. Under litter in tangles of bushy vegetation in Brownsville Region.

2. *Euthlastoblatta abortiva* (Caudell)

Tegmina considerably reduced and truncate distad in both sexes. Male subgenital plate with two very broad asymmetrical styles. General coloration buff, beautifully marbled and marked with blackish brown. Pronotum buffy, disk bordered rather narrowly with blackish brown and with an inverted anchor-shaped marking of this color. Under signs and dead bark on trees in humid eastern area.

3. *Aglaopteryx gemma* Hebard

5. Male with sixth abdominal tergite bearing mesad, at specialization of sixth and seventh tergites, two minute chitinous processes which are armed dorso-distad with elongate delicate teeth. Male styles not deflexed, of very unequal size. Structure generally less fragile. Male subgenital plate highly asymmetrical; styles not deflexed and of very unequal size. (Size below medium.).....6

Male with dorsal surface of abdomen simple or differently specialized, never with toothed processes characteristic of this sex in *Ischnoptera*. Male styles similar slender deflexed cylindrical processes, the dextral only slightly the longer. Structure more fragile, particularly in male. (Tegmina fully developed in male, variously developed in female. Terrestrial.).....7

6. Generally red-brown. Tegmina slightly reduced in female. Adventive; if established, in or near Gulf Coast ports.

6. *Ischnoptera rufa occidentalis* Saussure

Generally shining blackish brown, limbs and spines ochraceous-orange. Tegmina of female reduced to subquadrate weakly overlapping pads which are truncate distad. Generally under litter but usually in or near woodlands in eastern Texas.

7. *Ischnoptera deropeltiformis* (Brunner)

7. Dorsal surface of male abdomen not specialized. (Size small for the the genus.).....8

Dorsal surface of male abdomen specialized.....9

8. Male interocular space no wider than that between ocelli. Males light brown to ochraceous buff with head brown, female shining blackish brown. Female with tegmina reduced to very small lobiform lateral

pads and with supra-anal plate fully exposed. Pronotal sulci of male very pronounced. Under litter in east, central and southern Texas.
8. *Parcoblatta bolliana* (Saussure and Zehntner)

Male interocular space much wider than that between ocelli. Both sexes ochraceous buff with head pale, female abdomen darker on dorsal surface. Female with tegmina reduced to lateral, elongate rounded triangular pads and with seventh tergite produced so that only apex of supra-anal plate is exposed. Pronotal sulci of male less pronounced. Under litter in more arid western portions of Texas.
9. *Parcoblatta desertae* (Rehn and Hebard)

9. Male with median segment alone specialized.....10
Male with median segment and first tergite similarly specialized (each with twin specialized areas).....13
10. Male with median segment with a single specialized area.....12
Male with median segment with twin raised mesal ridges with cephalic faces supplied with a tuft of hairs.[7] (Size medium for genus.).....11
11. Specialized areas of median segment of male only weakly raised, with brief cephalic faces supplied with a tuft of hairs. Male subgenital plate elevated at base of dextral style. Female tegmina reduced to subquadrate, slightly overlapping pads which distad are convex, often showing some oblique truncation toward their sutural margins. Male ochraceous buff, female red-brown with abdomen blackish-brown dorsad, not pale-bordered, often paler ventrad. (Male cerci simple, with interno-distal angles of sixth to ninth segments not acutely produced as in *uhleriana*).[7] Under litter in east, central and south Texas.
12. *Parcoblatta fulvescens* (Saussure and Zehntner)

Specialized areas of median segment of male strongly raised, overhanging the segment, which is concave cephalad, ventral faces of overhanging extremities heavily supplied with short hairs. Male subgenital plate at base of dextral style not elevated. Female tegmina only moderately reduced, the apices roundly pointed to broadly convex, without trace of oblique truncation toward sutural margins. Male normally dark brown, tegmina dilute brownish with base of humeral vein dark, disk of pronotum dark brown, margins pale; female dark reddish-brown, dorsum and venter of abdomen blackish-brown, generally with narrow pale margins. Under bark and litter in humid eastern border of Texas.....15. *Parcoblatta divisa* (Saussure and Zehntner)

12. Male median segment with a moderately large median area supplied with minute scattered hairs. Size medium small for genus. Female tegmina reduced to truncate subquadrate slightly overlapping pads. Male ochraceous buff with head tawny; female hazel with head darker. Under litter, dead bark and signs on trees in forests of humid eastern area.....11. *Parcoblatta virginica* (Brunner)

[7] Similar specialization of the median segment of the male occurs in *Parcoblatta uhleriana* (Saussure), a common and widespread eastern species now known to occur southwest as far as Wyandotte, Oklahoma, which in distribution may well not reach as far as Texas. In this species the interno-distal angles of the sixth to ninth segments of the male cerci are acutely but briefly produced.

Male median segment with a median tuft of agglutinated hairs. Size medium for genus. Female tegmina only moderately reduced, not truncate. Light buffy brown; abdomen with transverse suffusions laterad in male, very conspicuously transversely banded in female. In open forests of northeastern area.....10. *Parcoblatta zebra* Hebard

13. Male abdominal specializations represented by weak elevations, the cephalic faces supplied with a heavy tuft of agglutinated hairs.....14

Male abdominal specialization represented by very decided elevations which overhang cephalad, with ventral surfaces there heavily supplied with hairs. (Size large for genus.) Female tegmina only moderately reduced, not truncate. Brown, often very dark, lateral margins of pronotum buffy. East, (rare in) central and south Texas.

16. *Parcoblatta pensylvanica* (DeGeer)

14. Size medium for genus. Form normal, not as broad. Male ochraceous buff; female generally (including tegmina) similar to that sex of *fulvescens* but meso-lateral portions of pronotal disk often suffused and darker. Under litter in east and central Texas.

13. *Parcoblatta caudelli* Hebard

Size large for genus. Form broader. Female tegmina much as in *fulvescens* but usually somewhat longer. Male ochraceous buff with a reddish tinge; female red brown with dorsal surface of abdomen blackish brown but showing transverse incomplete bands of red brown. Under bark and signs on pine trees, also on Sweet Gum, oaks and under litter in humid eastern area.....14. *Parcoblatta lata* (Brunner)

15. Structure moderately delicate (like preceding species). Relatively small species. Female subgenital plate simple (like preceding species). Male styles variously specialized. (Abdomen of male distinctively specialized.).....16

Structure heavily chitinous. Medium to large species. Female subgenital plate with a valvular meso-distal portion. Male styles similar, slender elongate straight and simple.....18

16. Ulnar vein of wing without proximal incomplete branches.....17

Ulnar vein of wing with proximal incomplete branches. (Antennae hirsute in proximal half. Pronotum rounded-angulate produced caudad. Tegmina fully developed in both sexes with discoidal sectors angulate at apex of anal field. Ventro-cephalic margin of cephalic femora with three heavy elongate distal spines. Male subgenital plate with styles specialized and very dissimilar. Generally russet to brownish black, pronotum reddish with buffy margins.) In weeds, flowers and litter of semi-arid regions. South, central and adjacent portion of east Texas.

17. *Pseudomops septentrionalis* Hebard

17. Tegmina fully developed in male, extending only to apex of abdomen in female; with strongly oblique discoidal sectors. Ventro-cephalic margin of cephalic femora with two heavy elongate distal spines. Male supra-anal plate strongly transverse, chitinous, little produced. Male

subgenital plate triangularly produced with large elongate styles directed along the margins toward the apex. Light reddish buff to deep reddish brown, female usually much the darker; lateral margins of pronotum and a transverse area in male (triangular in female) on tegmina pale. Fragile. Introduced, tropical, established. Domiciliary. 4. *Supella supellectilium* (Serville)

Tegmina fully developed in both sexes; with longitudinal discoidal sectors. Ventro-cephalic margin of cephalic femora with three heavy elongate distal spines. Male supra-anal plate greatly produced, diaphanous. Male subgenital plate highly asymmetrical with styles exceedingly small. Light buff with two longitudinal broad brown bands on pronotum. Moderately fragile. Introduced, temperate, established. Domiciliary.....5. *Blattella germanica* (Linnaeus)

18. Size relatively large. Arolia present. Organs of flight fully developed.....19

Size medium. Arolia absent. Tegmina covering about two-thirds of abdomen and truncate distad in male; reduced to small rounded trigonal lateral pads in female. (Male blackish chestnut brown, female even darker. Male with dorsal surface of abdomen unspecialized. Male supra-anal plate transverse, subrectangulate.) Introduced, temperate, established. Domiciliary.....22. *Blatta orientalis* Linnaeus

19. Male with dorsal surface of abdomen not specialized. Supra-anal plate of male greatly produced, diaphanous; of female with a deep acute-angulate median emargination. Cerci very elongate and slender distad. (Generally reddish brown. Pronotum light yellowish with caudal margin narrowly and two very large adjacent suffusions dark.) Tropical to mild temperate, adventive, established. Domiciliary. 18. *Periplaneta americana* (Linnaeus)

Male with median segment specialized mesad. Supra-anal plate of male entirely chitinous, roughly trapezoidal; of female with a much less deep median emargination. Cerci neither as elongate or as slender distad.....20

20. Ventral surface of male supra-anal plate not specialized. Generally reddish brown but not solidly colored.....21

Ventral surface of male supra-anal plate specialized. Solidly shining blackish brown. Probably introduced, subtropical, adventive, established. Domiciliary.....21. *Periplaneta fuliginosa* (Serville)

21. Tegmina unicolorous, pronotum much as in *americana*. Organs of flight slightly less caudate and size averaging slightly smaller than in that species. Tropical and subtropical, adventive, established. Domiciliary.....19. *Periplaneta brunnea* Burmeister

Tegmina deep bay with marginal field strikingly ochraceous buff. Pronotum ochraceous buff with an orange tinge, with two large sharply defined blotches of black. Tropical and subtropical, adventive, established. Domiciliary but also sometimes under litter and signs on trees.....20. *Periplaneta australasiae* (Fabricius)

22. Pronotum rounded-angulate produced caudad. (Supra-anal plate weakly bilobate. Ventral femoral margins unarmed except at apex. Size medium small. Organs of flight fully developed in male, usually slightly less so in female. Arolia present. Ocellar spots present. Dorsal surface of male abdomen not specialized.).....23
Pronotum not produced caudad.....24
23. Tegmina thickly supplied proximad with microscopic pits. Generally brown, pronotum shining blackish brown, narrowly margined cephalad or with latero-cephalic traces of buffy. Parthenogenetic in America and male here unknown. Ventral margins of femora with a single stout terminal spine; ventro-cephalic margin of cephalic femora fringed with hairs which become spiniform distad. Terrestrial. South-central and south Texas.....23. *Pycnoscelus surinamensis* (Linnaeus)
Tegmina not pitted proximad. Light green. Ventral margins of femora with or without a terminal spine; ventro-cephalic margin of cephalic femora fringed with hairs. (Male subgenital plate produced as an asymmetrical lobe, styles minute.) In green vegetation. Brownsville Region.....24. *Panchlora cubensis* Saussure
24. Head rounded triangular with face flattened. Tarsal claws asymmetrical. Subgenital plate of male with styles inset mesad and produced as elongate attingent scutes, of female with a short medio-longitudinal distal cleft. Male with sixth tergite specialized mesad. Wings with an appendicular field which is wider than long; radiate field normal, folding fan-wise. (Ocellar spots absent. Fourth caudal tarsal joint alone bearing a pulvillus. Arolia large. Organs of flight fully developed in male, slightly less caudate in female. General coloration ochraceous-buff with a tawny tinge.) In foliage of trees and bushes. Southeast, south central and south Texas.
1. *Chorisoneura texensis* Saussure and Zehntner
Head of more rounded normal form. Tarsal claws symmetrical. Subgenital plate of both sexes of different type. Dorsal surface of male abdomen not specialized. Wings, when developed, without an appendicular field; radiate field not folding. Female apterous.....25
25. Sexes only moderately dissimilar. Ventro-cephalic margin of caudal femora alone supplied with spines. Male with tegmina rhomboidal, slightly overlapping, truncate; wings vestigial. (Size minute, (length under 3 mm.). Male subgenital plate very asymmetrical, styles absent. Cerci reduced to flattened lobes. Female subgenital plate simple. Very large arolia present. Generally light yellowish.) In ant nests. Central Texas.....26. *Attaphila fungicola* Wheeler
Sexes exceedingly dissimilar. Ventro-cephalic margin of caudal femora without spines. Male organs of flight fully developed.....26
26. Size very small. Male tegmina with a conspicuous diagonal channel. Ocelli absent. Subgenital plate of male symmetrical with simple slender similar styles; of female valvular. Arolia vestigial in male;

absent in female. (Light brown.) Under stones; perhaps also under bark. South-central and south Texas.
25. *Compsodes schwarzi* (Caudell)

Size large to medium small. Male tegmina lacking a diagonal channel. Ocelli highly developed in male; suggested by weakly defined spots in female. Subgenital plate of male asymmetrical, lacking styles; of female simple. Arolia absent.....27

27. Median and caudal femora with a disto-dorsal genicular spine. Ventral femoral margins supplied with numerous stiff hairs. Male supra-anal plate produced, diaphanous, weakly bilobate. Male subgenital plate with surface not specialized.....28

Median and caudal femora lacking a disto-dorsal genicular spine. Ventral femoral margins supplied with very elongate numerous silky hairs; female also with ventro-cephalic margin of cephalic femora with more closely placed proximal and more widely separated distal short stout spines and with ventro-caudal margins of median and caudal femora bearing short stout spines. Male supra-anal plate not produced. Male subgenital plate with surface areas specialized and spinose. (Size medium small. Male generally buffy brown, pronotum often deeper and more reddish except narrowly cephalad and frequently mesad; female dark brown.) Under litter in arid areas of extreme western Texas.....31. *Eremoblatta subdiaphana* (Scudder)

28. Males: tegmina and wings fully developed; subgenital plate asymmetrical.....29

Females: apterous; subgenital plate simple, convex, symmetrical.....32

29. Sinistral genital hook strongly recurved distad to its slender, acute apex. Dextro-ventral genital plate not as in alternative. Coloration varying from blackish, with cephalic margin of pronotum buff, to buffy with pronotal disk dark and tegmina feebly to strongly tessellate.[8].....30

Sinistral genital hook barbed distad, like a fish-hook, slightly thicker above the barb than in middle portion of shaft. Dextro-ventral genital plate relatively small, with margins rounded and smooth. Coloration buffy, pronotal disk often darker, brown or red-brown, tegmina sometimes vaguely mottled.[8].....31

30. Size large to medium. Dextro-ventral genital plate large, rotundato-quadrate, not showing deep emargination, its surface concave with distal portion very broadly and conspicuously shagreenous. Dextro-dorsal genital plate small, but with sinistro-distal portion produced and

[8] The ranges of the two species falling under each section of the above rubric apparently do not overlap. The males cannot safely be identified except by the difference in the concealed genitalia. Of the first pair, *bolliana* averages much larger than *grata,* and is the largest of the four species occurring in the State; of the second pair, *erratica* and *tonkawa,* all of the largest males known from Texas represent *tonkawa.* Females of *bolliana* may be distinguished by their large size and suborbicular form, those of *grata* by their color pattern; *erratica* and *tonkawa* are apparently inseparable in this sex.

lobate. Coloration varying as described above, but tegmina often suffused or extensively mottled with blackish. North-central, central and south Texas.....27. *Arenivaga bolliana* (Saussure)

Size medium. Dextro-ventral genital plate cleft to near base dextrad, the sinistral portion roundato-rectangulate and longer than broad, the distal margins smooth, the dextral portion a stout chitinous rounded projection which curves sinistrad with apex touching the dextral margin of the sinistral portion mesad. Dextro-dorsal genital plate relatively very small, narrowly transverse, with exposed surface rounded. Coloration less dark, tegmina finely tessellate with brownish. Chisos Mountains in extreme southwestern Texas.

28. *Arenivaga grata* Hebard

31. Dextro-ventral genital plate vertically broad, with margins rounded and surface comparatively smooth, not broadly and deeply emarginate toward dextro-dorsal plate. Under litter in arid portions of west Texas.....29. *Arenivaga erratica* Rehn

Dextro-ventral genital plate vertically narrow, broadly and roundly angulate-emarginate to near its base sinistrad of median point, the dextral portion thus formed a small smooth rounded lobe, the sinistral portion an irregularly rounded angulate projection of equal height. Drier portions of north-central, central and south Texas.

30. *Arenivaga tonkawa* Hebard

32. Size large to medium; form suborbicular. General color blackish, with two narrow buffy marginal areas cephalad which may fuse into a continuous band with caudal edge brace-shaped. North-central, central and south Texas.....27. *Arenivaga bolliana* (Saussure)

Size medium to rather small; form narrower, broad-oval to oval. General color light to dark reddish-brown, cephalic margin of pronotum usually with continuous or interrupted narrow paler edging.....33

33. Pronotum with a small, weakly defined, triangular yellowish suffusion near the cephalic margin on each side of median line. Interocular space slightly narrower than that between the ocelli. Chisos Mountains in extreme southwestern Texas.....28. *Arenivaga grata* Hebard

Pronotum narrowly bordered with pale cephalad. Interocular space slightly broader than that between the ocelli.....34

34. Occurring in arid portions of west Texas.[9]..29. *Arenivaga erratica* Rehn

Occurring in drier portions of north-central, central and south Texas.[9]

30. *Arenivaga tonkawa* Hebard

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[9] Not only are the sexes of *Arenivaga* and *Eremoblatta* astonishingly dissimilar in form and appearance (due to the lack of organs of flight in females), but the shape of the head, clypeus, ocelli and (particularly in the latter genus) the armament of the limbs is widely different. As is the case in other Blattidae when sexual dimorphism is found, the female shows much closer agreement with the form and structure of the immature stages.

CHORISONEURINAE

Chorisoneura texensis Saussure and Zehntner

1893. *Chorisoneura texensis* Saussure and Zehntner, Biol. Cent.-Amer., Orth., I, p. 80. [♂: New Mexico;[10] Texas.]

1917. *Chorisoneura texensis* Hebard, Mem. Amer. Ent. Soc., No. 2, p. 247, pl. X, figs. 7 and 8.

Caudell recorded this delicate insect from San Tomas near Brownsville in 1904, while I reported it from near Waco, Brownsville and the Esperanza Ranch near Brownsville in 1917.

Orange County, XII, 25, 1921, (R. H. Beamer), 2 juv. ♂. Brownsville, VII, 31, 1906, 1 ♂, 1 ♀, [Ill. State and Hebard Clns.].

Waco is a northwestern and Brownsville a western limit for this species, which is widely distributed but as a rule scarce in the southeastern United States.

The great majority of specimens I have secured were beaten from the foliage of bushes.

PSEUDOMOPINAE

Euthlastoblatta abortiva (Caudell)

1904. *Anaplecta abortiva* Caudell, Mus. Brooklyn Inst. Arts and Sci., Bull., I, p. 105. [♀; Esperanza Ranch near Brownsville, Texas.]

1917. *Euthlastoblatta abortiva* Hebard, Mem. Amer. Ent. Soc., No. 2, p. 28, pl. I, figs. 1 to 8.

Brownsville, IX, 22, 1924, (Weed and Pray), 12 ♂, 3 ♀, 2 juvs., [Field Mus. Nat. Hist.]; XII, 1 and 10, 1910 and 1911, (in nest of rat, *Neotoma* sp. and under bark of dead hackberry), 2 ♀, [Ill. State]. Cameron County, VIII, 3, 1928, (R. H. and L. D. Beamer), 2 ♂, 3 ♀.

This beautiful species is present in the United States only in the bottom-lands of the Brownsville Region in the semi-arid subtropical environment, where it is abundant in the dead leaves, dry litter and rat's nests of the heavy scrub. It is now known to be a member of a genus widely distributed in the tropics of North America.

[10] I have already published the fact that material of this, as well as a number of other species, has been recorded from "New Mexico" or "New Mexico or Texas" incorrectly. The northwestern limit of distribution of the present species lies far to the east of New Mexico. Texas is therefore here selected as type locality.

Aglaopteryx gemma Hebard

1917. *Aglaopteryx gemma* Hebard, Mem. Amer. Ent. Soc., No. 2, p. 32, pl. I, figs. 9 to 12. [♂, ♀; type locality—Mobile, Alabama.]

Immatures of this beautiful little species were secured and reported by the author from Beaumont and Houston in 1917. The latter is a western limit for the insect, which is widespread in the Sabalian Zone of the southeastern United States and is known also from Nassau in the Bahamas. Usually found in hiding places on trees, I have only once found a specimen under a stone on the ground.

Supella supellectilium (Serville)

1839. *Blatta supellectilium* Serville, Hist. Nat. Ins., Orth., p. 114. [♂, ♀; Mauritius.]

1917. *Supella supellectilium* Hebard, Mem. Amer. Ent. Soc., No. 2, p. 47, pl. I, figs. 24 to 27.

1937. *Supella supellectilium* Back, Proc. Ent. Soc. Wash., XXXIX, p. 205, text figs. 1 and 2; pl. 19, figs. 2 and 3.

An adventive from the tropics, carried around the world by commerce, this household pest has not only become widely established in the southern United States but is also rapidly increasing in abundance and extending its distribution northward. It has been recorded by Back in 1937, from Dallas, Houston, Austin, San Antonio and San Angelo, Texas.

Dallas, VII, 1931, (J. K. G. Silvey), 1 ♂.* Dallas County, 1936, 1 ♂, [Hebard Cln.]. Waxahachie, XI, 16, 1931, (F. B. Isely), 1 ♀. Austin, 1931, (J. K. G. Silvey), 1 ♂.* Travis County, 1931, (J. K. G. Silvey), 3 ♂, 2 ♀.* College Station, V, 2, 1933, (H. J. Reinhard), 1 ♂. Pecos, VIII, 17, 1935, (T. H. Hubbell; in tourist cabin), 1 ♂.*

Northern limits, many published in the last few years, are Swarthmore, Pennsylvania (Rehn, 1938); Indianapolis, Indiana; Chicago and Urbana, Illinois; "Nebraska"; Ft. Leavenworth, Kansas; San Angelo, Texas; Tucson, Arizona (Hebard, 1935), and San Bernardino, California (Rehn, 1940). Some of the more eastern localities are undoubtedly far north of the areas where the species may be considered permanently established.

Blattella germanica (Linnaeus)

1767. *B[latta] germanica* Linnaeus, Syst. Nat., Ed. XII, p. 688 [Denmark].
1917. *Blattella germanica* Hebard, Mem. Amer. Ent. Soc., No. 2, p. 57, pl. II, figs. 6 to 9.

I recorded this species from Mineola and Carrizo Springs in 1917.

Six ♂, 4 ♀, taken IV, 11 to XI, 5, and one immature individual are from Dallas, Austin,* Travis County,* College Station, Taylor, Victoria, Brownsville and Bexar County.

This cockroach is an ubiquitous household pest, introduced from Europe and now generally distributed throughout the United States.

Ischnoptera rufa occidentalis Saussure

1862. *I[schnoptera] occidentalis* Saussure, Rev. et Mag. de Zool., (2), XIV, p. 170. [[New] Orleans, Louisiana.]
1916. *Ischnoptera rufa occidentalis* Hebard, Trans. Amer. Ent. Soc., XLII, p. 352, pl. XVI, fig. 7.

I placed as a synonym *I. consobrina* Saussure in 1916, under which name Saussure and Zehntner recorded Texas material in 1893, and at the same time I recorded a female from the Gulf Coast of Texas.

Widespread in tropical North America, it is probable that this terrestrial red-brown cockroach is an adventive in Texas. It may have established itself in small colonies at ports along the Gulf Coast, but in the considerable amount of field work which in recent years has been done there, no additional material has been discovered.

Ischnoptera deropeltiformis (Brunner)

1867. *T[emnopteryx] deropeltiformis* Brunner, Nouv. Syst. Blatt., p. 87. [♂, ♀; North America.]
1917. *Ischnoptera deropeltiformis* Hebard, Mem. Amer. Ent. Soc., No. 2, p. 63, pl. II, figs. 10 to 15.

I recorded this species from Paris, Dallas, Waco, Tiger Mills, Boerne, Kerrville, Hockley and Victoria in 1917.

Eight ♂, 9 ♀, taken from IV, 1 to VIII, 3, and 10 immature specimens are from Marion County, Ben Wheeler, Athens (in timbered bog), Dallas,* Dallas County, Midlothian, Maypearl, Ellis County, Austin,* College Station, Richmond, Colorado County and Victoria.

Dallas, Waco, Kerrville and Victoria, are western limits of this terrestrial cockroach, which is widespread but usually rather scarce throughout all but the northern portion of the eastern United States. It prefers damp open woodlands.

Parcoblatta bolliana (Saussure and Zehntner)

1893. *Ischnoptera bolliana* Saussure and Zehntner, Biol. Cent.-Amer., Orth., 1, p. 4. [♂, Texas.[11]]

1917. *Parcoblatta bolliana* Hebard, Mem. Amer. Ent. Soc., No. 2, p. 77, pl. III, figs. 1 to 3.

The synonymy of *Kackerlac schaefferi* Rehn, based on a female from the Esperanza Ranch, near Brownsville, was indicated by Rehn and Hebard in 1910. A female labelled "Texas" was incorrectly referred to *Kakerlac* (*Loboptera*) *americana* Scudder by Hart in 1906.

I recorded *bolliana* from Paris, Waco, Hockley, Dickinson, Round Mountain, Austin, Rio Frio, Sabinal, Sharpsburg, Nuecestown, San Diego, Brownsville and Point Isabel in 1917.

Twenty-seven ♂, 14 ♀, taken IV, 15 to VIII, 4, and 5 immature individuals are from Dallas County, Waxahachie, Camp Wisdom near Waxahachie, Maypearl, Ellis County, Alvarado, College Station, Harris County, Colorado County, Worth Ranch in Palo Pinto County, Eastland County, Kerrville (at light), Live Oak County, Cotulla, Encinal and Brownsville.

Isely writes that this diminutive species, abundant in northeastern Texas in the Spring, was taken at light and in jar traps.

Western limits are Eastland County, Rio Frio, Cotulla and Encinal.

Parcoblatta desertae (Rehn and Hebard)

1909. *Ischnoptera desertae* Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1909, p. 116, fig. 1. [♀; Johnstone, Valverde County, Texas.]

1917. *Parcoblatta desertae* Hebard, Mem. Amer. Ent. Soc., No. 2, p. 81, pl. III, figs. 4 to 6.

Males of this species from Shovel Mountain were incorrectly recorded by Rehn as *Ischnoptera bolliana* in 1903 and were the

[11] I am satisfied that Saussure and Zehntner's material was incorrectly recorded as from "Texas and New Mexico."

basis for the synonym *Ischnoptera insolita* Rehn and Hebard in 1912 (this mistake having been due to failure at that time in properly associating the sexes). I recorded this species from Rio Frio, Sabinal, the Nueces River in Zavalla County, Fort Davis and the Chisos Mountains in 1917.

One hundred and eight ♂, 17 ♀, taken IV, 30 to VIII, 6, and 10 immature individuals, are from the Worth Ranch in Palo Pinto County, Seguin, Three Rivers, Catarina, Carrizo Springs, Dimmit County (in light trap), Winter Haven, Sheffield, (4 ♀ taken about ant nest, *Ischnomyrmex* sp.), Fort Davis, Culberson County, Alpine, the hills west of the Ord Mountains in Brewster County, Juniper Canyon in the Chisos Mountains (at light and on ground, in dry creek bed through scrub oak, pine and juniper forest, and in the Basin at 6500–7000 feet),* Mt. Chilicotal near Glenn Spring in the Chisos Mountains (in juniper forest on summit of west ridge)* and Presidio.

This small distinctive species I now have from East as far as Three Rivers, Seguin and Palo Pinto County, Texas, and the Wichita National Forest, Oklahoma. North to the latter, Sheffield, Texas and Tucumcari, New Mexico. West to Tucumcari and Carlsbad, New Mexico, and the Davis and Chisos Mountains, Texas. It is undoubtedly present in adjacent northeastern Mexico.

Parcoblatta zebra Hebard

1917. *Parcoblatta zebra* Hebard, Mem. Amer. Ent. Soc., No. 2, p. 89, pl. III, figs. 10 to 14. [♂, ♀; type locality—Pulaski, Illinois.]

I have noted that in the series recorded as *Ischnoptera uhleriana* by Saussure and Zehntner in 1893, material of this species was included, as the figured female undoubtedly represents it. A male of *zebra* from Dallas, now in the author's collection, received in exchange from the Geneva Museum, labelled *"Ischnoptera uhleriana"* strongly suggests that the female mentioned above came from that locality. Here again we have "Texas and New Mexico" given by Saussure and Zehntner, though neither *uhleriana* or *zebra* is found as far west as the latter State and *zebra* is present only in eastern Texas.

I also recorded material of *zebra* from Dallas and Victoria, these being western limital points for the species, which is now known to have a wide distribution in the Mississippi Valley.

Parcoblatta virginica (Brunner)

1865. *T[emnopteryx] virginica* Brunner, Nouv. Syst. Blatt., p. 86 [♀; Draper's Valley, Virginia].

1917. *Parcoblatta virginica* Hebard, Mem. Amer. Ent. Soc., No. 2, p. 96, pl. IV, figs. 1 to 5.

Marshall, VII, 18, 1935, (I. J. Cantrall; from molasses trap in moist woods of maple, oak and pine, with much undergrowth and heavy layer of duff) 1 ♂.* Devers, Liberty County, VIII, 14, 1935, (T. H. and G. G. Hubbell; in molasses traps in open, rather dry woodlot of Spanish Oak and other trees on hillside, and in low wet woods of Willow Oak, etc., with black, loamy soil, along creek) 12 ♀.*

These are the first records from Texas of this widespread and common eastern species, which in this State is probably confined to the narrow, more humid eastern marginal area.

Western limital records for the species are: Springfield, South Dakota; Ashland and Lincoln, Nebraska; Wallace County, Kansas; Idabel, Oklahoma [♂, Hebard Cln.], and Marshall and Devers, Texas, the latter being a southern limital point as well.

Parcoblatta fulvescens (Saussure and Zehntner)

1893. *Ischnoptera uhleriana fulvescens* Saussure and Zehntner, Biol. Cent.-Amer., Orth., I, p. 36, pl. III, fig. 23. [♂; type selected by Hebard in 1934—Georgia.[12]]

1917. *Parcoblatta fulvescens* Hebard, Mem. Amer. Ent. Soc., No. 2, p. 114, pl. IV, figs. 13 to 16.

Davis was the first to point out that in 1917 I confused females of the present species and brachypterous females of *caudelli*.[13] In Texas the brachypterous females of these species are particularly difficult to distinguish, as the degree of tegmina truncation is individually highly variable, and the abdomen above and below is almost invariably shining black. The very rarely found macropterous females referred by me in 1917 to *caudelli* may or may not belong to that species; it is quite possible that two or all of the

[12] New Mexico and Texas were again given by Saussure and Zehntner, the former probably once more in error. Exactly the same error occurred when they described the synonym of the present species, *Temnopteryx texensis*, of which a female paratype, from Dallas, Texas, is in the author's collection.

[13] Journ. N. Y. Ent. Soc., XXXIII, p. 188, (1925).

species *virginica, caudelli* and *fulvescens* may develop such a condition. No macropterous females have as yet been taken in Texas.

Thirty-three ♂, 65 ♀, taken V, 24 to VIII, 20, and 4 immature individuals are from Marshall,* Ben Wheeler, Dallas, Fort Worth, Midlothian, Waxahachie, Reagor Springs, Maypearl, Ellis County, Alvarado, Cleburne, Johnson County, Clifton, Iowa Park, Worth Ranch in Palo Pinto County, Austin,* Galveston,* Aransas County (a very small male), Luling * (small female showing maximum brachypterism), Kerr County, Padre Island and Brownsville.

Material was incorrectly recorded as *Ischnoptera uhleriana* by Caudell from Victoria in 1903 and from Esperanza Ranch in 1904. I recorded this species in 1917 from Paris, Dallas, Tyler, Waco, Shovel Mountain, Round Mountain, Rosenberg, Victoria, San Antonio, Live Oak County, Nueces River in Zavalla County, Brownsville and San Tomas.

Western limits for *fulvescens,* widespread over the southern half of the eastern United States, are Iowa Park, Worth Ranch in Palo Pinto County, Kerr County and the Nueces River in Zavalla County.

Parcoblatta caudelli Hebard

1917. *Parcoblatta caudelli* Hebard, Mem. Amer. Ent. Soc., No. 2, p. 122, figs. 1 to 5. [♂, ♀; type locality—Raleigh, North Carolina.]

1925. *Parcoblatta caudelli* Davis, Jour. N. Y. Ent. Soc., XXXIII, p. 188.

I originally reported material of *caudelli* from Dallas and Waco.

Six ♂ and 1 ♀, taken V, 20 to VIII, 3, are from Ben Wheeler (♀), Plano, College Station and Rock Island.

The Texan males before me average distinctly smaller than those of *P. fulvescens.*

Western limits of this species, which occurs over more than the southern half of the eastern United States excepting peninsular Florida, are therefore Plano, Dallas, Waco, College Station and Rock Island.

Parcoblatta lata (Brunner)

1865. *I[schnoptera] lata* Brunner, Nouv. Syst. Blatt., p. 135. [♂, North America.]

1917. *Parcoblatta lata* Hebard, Mem. Amer. Ent. Soc., No. 2, p. 126, pl. V, figs. 6 to 10, pl. VI, fig. 1.

This large reddish species was incorrectly recorded as *Ischnoptera couloniana* from Hockley and "Texas" in 1910 by Rehn and Hebard. This error was corrected by me in 1917, at which time the species was also recorded from Jacksonville and Beaumont.

Devers, VIII, 14, 1935, (T. H. and G. G. Hubbell; taken with *P. virginica* in molasses traps in low, wet, oak woods and in drier woodlot on hillside), 3 ♀, 1 juv. ♂.*

This insect is found in the forests of the southeastern United States, and is especially abundant there in the pinelands of the Coastal Plain. It is not known from peninsular Florida south of Alachua County * and Gulf Hammock in Levy County. Northern limits are: Delaware; Glendale, Maryland; Johnson City,* Tennessee; Mammoth Cave,* Kentucky; Wyandotte, Indiana; Martinsville,* Illinois; St. Louis, Missouri; and Douglas County, Kansas. Western limits are: Douglas County, Kansas; Payne County, Oklahoma [Hebard Cln.], and Jacksonville and Hockley, Texas.

Parcoblatta divisa (Saussure and Zehntner)

1893. *Ischnoptera divisa* Saussure and Zehntner, Biol. Centr.-Amer., Orth., I, p. 40 [♂, Georgia; [not] northern Mexico].

1917. *Parcoblatta divisa* Hebard, Mem. Amer. Ent. Soc., No. 2, p. 133, pl. V, figs. 11 to 16.

This species was incorrectly placed as a race of *P. pensylvanica* by Blatchley in 1920.

Devers, VIII, 14, 1935, (T. H. and G. G. Hubbell; in molasses traps in low, wet open forest of oak and other trees, along creek, with *P. virginica*), 3 ♀.*

Intensively colored females closely resemble and are often difficult to separate from small females of *P. pensylvanica,* especially since both species exhibit a considerable amount of variation in degree of development of the tegmina.

The present species is widespread in the southeastern United States, occupying habitats as diverse as dry pinelands, oak scrub, moist hammocks in northern Florida and the deep, cool ravines along the Apalachicola River.[14] Scarce in collections, Hubbell has

[14] In Alachua County,* Florida, *P. divisa* occurs in a strikingly pale phase which bears a close superficial resemblance to *P. zebra;* no individuals of the typical dark phase are represented in the series of several hundred specimens studied from this locality, in the University of Michigan collection, nor has this pale phase been taken elsewhere.

found this species abundant at various localities in southern Georgia and northern Florida. The range includes the Atlantic Coastal Plain and adjacent parts of the Piedmont, from southern New Jersey and easternmost Pennsylvania south to White Sulphur Springs,* Georgia, and Gainesville,* Monticello,* and Liberty County,* Florida; thence it spreads westward in the Gulf Coastal Plain and lower Mississippi Valley, limital records for this part of its range being: on the north, Opelika, Alabama; Pontotoc,* Mississippi; South Fulton,* Tennessee; West Helena,* Arkansas, and Sawyer and McCurtain County, Oklahoma. Western limits are indicated by the two last localities and Devers, Texas.

Parcoblatta pensylvanica (DeGeer)

1773. *Blatta pensylvanica* DeGeer, Mem. l'Hist. Ins., III, p. 537, pl. 44, fig. 4. [♂, Pennsylvania.]

1917. *Parcoblatta pensylvanica* Hebard, Mem. Amer. Ent. Soc., No. 2, p. 139, pl. V, figs. 17 to 20, pl. VI, figs. 2 to 4.

The synonym *Ischnoptera inaequalis* Saussure and Zehntner was described in 1893, based on material from Texas.[15] Caudell recorded a male from the Esperanza Ranch as the synonym *Ischnoptera couloniana* Saussure in 1904 and the author reported the species correctly from Byers, Dallas and Waco in 1917.

Four ♂, 22 ♀, taken V, 17 to IX, and 4 immature individuals, are from Bowie County, Waxahachie, Maypearl, Ellis County, the Worth Ranch in Palo Pinto County, Eastland County, Travis County,* Lytton Springs,* College Station and Jackson County.

A single female from Maypearl is very unusual in having the pronotum almost solidly blackish brown, the normal pale lateral margins being barely indicated.

The western limits in Texas for this large, bicolored, widely distributed eastern woodland cockroach (which, however, is not found in peninsular Florida) are Byers, Eastland County, Waco, Travis County, Lytton Springs, Jackson County and the Esperanza Ranch, near Brownsville.

Pseudomops septentrionalis Hebard

1917. *Pseudomops septentrionalis* Hebard, Mem. Amer. Ent. Soc., No. 2, p. 156, pl. VI, figs. 5 to 8. [♂, ♀; type locality—Brownsville, Texas.]

[15] In this case "North Mexico" was given also, but possibly in error.

This species was recorded incorrectly as *Thyrsocera cincta* by Scudder in 1900 from Texas, by Caudell in 1904 from Topo, and as *Pseudomops oblongata* by Rehn in 1907 from Brownsville, while the latter material was referred to *Pseudomops intercepta* by Caudell in 1913. When describing the species I also recorded it from Dallas, Waco, Blanco County, Columbus, Zavalla County, Carrizo Springs, Del Rio, Mercedes, Santa Maria, the Piper Plantation, the Esperanza Ranch, San Tomas and the Rocha Ranch.

Eighteen ♂, 50 ♀, taken III, 23, to VII, 14, and 1 immature individual are from New Boston, Nacogdoches, Dallas, Waxahachie, Gurley, Ellis County, Clifton, College Station, Richmond, Live Oak, Victoria, Eastland County, McLennan County, Taylor, Austin, Travis County,* New Braunfels, Kerrville (2 of 3 ♂ teneral, taken V, 22), Helotes, Kendall County, San Antonio, Sutherland Springs, Brownsville, Cameron County, Menard County and Devils River.

The distribution of this beautiful insect, which lives largely in herbage, extends east to Live Oak, Richmond, Nacogdoches and New Boston, Texas: north to New Boston, Texas; Murray County * and the Wichita Mountains,* Oklahoma; and west to Eastland County, Menard County and Devils River, Texas. In northern Mexico it is found from the Gulf of Mexico to the Pacific. It is the northernmost representative of an extremely large tropical American genus.

BLATTINAE

Periplaneta americana (Linnaeus)

1758. [*Blatta*] *americana* Linnaeus, Syst. Nat., Ed. X, p. 424. [America.]
1917. *Periplaneta americana* Hebard, Mem. Amer. Ent. Soc., No. 2, p. 178, pl. VII, figs. 3 to 11.

This large household cockroach was recorded from College Station, Houston and Galveston by Hart in 1906.

Fifteen ♂, 10 ♀, taken III, 19 to XI, 17 (the majority in June) and 6 immature individuals are from Beaumont, Terrell, Dallas County, Ellis County, Palo Pinto,* College Station, Galveston, Dickinson, Victoria, Corpus Christi, Shovel Mountain, San Antonio, Del Rio and Brownsville.

Distributed by commerce throughout the tropics and far into the temperate regions, the species origin is uncertain though the evidence for a southern Asiatic source is strongest. It probably occurs throughout Texas.

Periplaneta brunnea Burmeister

1938. *P[eriplaneta] brunnea* Burmeister, Handb. Ent., II, Abth. II, pt. 1, p. 503. [♂, ♀; Chile; Demerara [= British Guiana].]

1917. *Periplaneta brunnea* Hebard, Mem. Amer. Ent. Soc., No. 2, p. 182, pl. VII, figs. 12 to 16.

I recorded this species from Katherine, Texas, in 1917.

Dickinson, VI, 1929, (F. M. Hull), 1 ♂. Harvester, X, 30, 1902, (S. W. Thuron), 1 ♀. Calvert, (G. H. Harris), 1 ♀. Ganado, VIII, 6, 1921, (C. D. Duncan), 1 ♀, [Cal. Acad. Sci.]. Black Bayou, V, 22, 1907, 1 ♂, 1 juv. ♀, [Ill. State].

Though also carried around the world by commerce, this demociliary species, likewise probably of southern Asiatic origin, is not found distributed as far from the tropics as the preceding and in Texas probably occurs most frequently in the towns and cities near the coast. In the United States it has not yet been reported from north or west of the above localities, though in the East a colony has been found (indoors) as far north as Philadelphia.

Another species, *Periplaneta australasiae* (Fabricius), is so widespread by commerce through the tropical and subtropical regions that it is certain to be (and indeed has probably been) introduced and should become established, at least indoors, along the Gulf Coast of Texas. It has already become widely established out of doors on the Florida peninsula.

Periplaneta fuliginosa (Serville)

1839. *Kakerlac fuliginosa* Serville, Hist. Nat. Ins., Orth., p. 70. [♂, North America.]

1917. *Periplaneta fuliginosa* Hebard, Mem. Amer. Ent. Soc., No. 2, p. 188, pl. VII, figs. 20 to 24.

I recorded this species from Orange and Victoria in 1917.

Waxahachie, VI, 4, 1934, (F. B. Isely; in house), 1 ♀. Dickinson, VI, 1929, (F. M. Hull), 2 ♂, 1 ♀.

Its distribution in Texas is probably very similar to that of *brunnea,* but a colony was recently recorded by me from as far north as Chicago, Illinois.

Though nearest the Japanese *P. picea* Shiraki, this domiciliary insect has, except for these records, been found only in the southeastern United States.

Blatta orientalis Linnaeus

1758. [*Blatta*] *orientalis* Linnaeus, Syst. Nat., Ed. X, 1, p. 424. [America; the East; Russia; Stockholm, Sweden; Finland.]

1917. *Blatta orientalis* Hebard, Mem. Amer. Ent. Soc., No. 2, p. 173, pl. VII, figs. 1 and 2.

I recorded this disgusting insect from Denton and Marathon in 1917.

Six ♂ and 6 ♀, taken IV, 31 to VII, 3, are from Dallas, Ellis County and the S. G. Ranch in Brewster County.

This household pest occurs in most of the cities and towns of Texas. It is least common in the colder as well as the more arid portions of the United States.

Recent studies of the genus to which this species belongs, being conducted by James A. G. Rehn, strongly indicate that this domiciliary pest, now generally distributed in temperate regions by commerce, originated in Africa and not in Asia as has been supposed.

PANCHLORINAE

Pycnoscelus surinamensis (Linnaeus)

1767. [*Blatta*] *surinamensis* Linnaeus, Syst. Nat., Ed. XII, p. 687. [Surinam.]

1917. *Pycnoscelus surinamensis* Hebard, Mem. Amer. Ent. Soc., No. 2, p. 192, pl. VIII, fig. 1.

Caudell recorded this insect from the Rocha Ranch (in error as Rock's) and the Esperanza Ranch as *Leucophaea surinamensis* in 1904 and I reported it from Victoria, San Antonio, Sinton and Brownsville in 1917.

Brownsville, V, 12, 1927 and XII, 7, 1910, 9 ♀, 5 juv. ♀, [Ill. State]; (H. S. Barber), 1 ♀; 1918, (R. D. Camp), 1 ♀, 2 juv. ♀.* Cameron County, VIII, 3, 1928, (L. D. Beamer), 7 ♀.

This common terrestrial tropical insect is confined in Texas to the Brownsville Region. It has been carried around the world by commerce. It is parthenogenetic in the New World, but such is not the case in southeastern Asia, in which region it probably originated.

Panchlora cubensis Saussure

1862. *P[anchlora] cubensis* Saussure, Rev. et Mag. de Zool., (2), XIV, p. 230. [♀, Cuba.]

1917. *Panchlora cubensis* Hebard, Mem. Amer. Ent. Soc., No. 2, p. 198, pl. VIII, figs. 2 to 5.

The species was recorded by Caudell as *Panchlora exoleta* from the Esperanza Ranch in 1904; correctly by the author from there and Brownsville in 1917, and an immature as the synonym *Pycnosceloides aporus* in 1919.

Brownsville, V, 25 and VI, 1, 1924, (J. N. Knull), 1 ♂, 1 ♀. Cameron County, VIII, 3, 1928, (J. G. Shaw), 1 ♂, [Hebard Cln.]. Hidalgo County, X, 8, 1933, (J. W. Monk), 1 ♀.

This quite uniformly pale green cockroach lives in foliage and the green sheaths of plants and is very widely distributed through the American tropics. It reaches its northern limit of distribution in the vicinity of Brownsville. It is frequently introduced into the United States in fruit, but has never been even temporarily established anywhere by this means and would certainly not be able to survive the winter climate except in the very restricted subtropical sections. Though widely distributed through the West Indies it is not found native in Florida.

CORYDIINAE

Compsodes schwarzi (Caudell)

1903. *Latindia schwarzi* Caudell, Proc. Ent. Soc. Washington, V, p. 165. [♂: Madera Canyon, Santa Rita Mountains, Arizona.]

1917. *Compsodes schwarzi* Hebard, Mem. Amer. Ent. Soc., No. 2, p. 210, pl. X, figs. 1 to 4.

Wallisville, XI, 5, 1918, (H. S. Barber), 1 ♀, [Hebard Cln.]. Richmond, VI, 22, 1917, (on Brazos River), 1 ♂, [Hebard Cln.]. San Antonio, VI, 25, 1938, (D. W. Craik), [Hebard Cln.]. Dimmit County, VI, 7, 1933, (H. J. Reinhard; in light trap), 1 ♂.

The previously unknown female differs greatly from the male in being apterous, minutely setose, with head proportionately larger,

eyes very greatly reduced, pronotum proportionately larger and broad with caudal margin truncate, the latero-caudal angles of the mesonotum and metanotum somewhat produced and well rounded angulate at slightly less than a right angle, subgenital plate strikingly valvular and arolia absent.

This exceedingly small, and in the male sex extremely delicate, cockroach was recorded from Brownsville by Caudell in 1904, and from Beeville, Sabinal, the Nueces River in Zavalla County, Brownsville and the Esperanza Ranch by Hebard in 1917.

Its distribution in northern Mexico is undoubtedly very extensive, but outside of Texas it is known only from the Santa Rita and Baboquivari Mountains * and Yavapai County,* Arizona.

In Texas the species occurs east to Wallisville, north to that locality, Richmond, Beeville, San Antonio and Sabinal, and west to the latter locality and the Nueces River in Zavalla County.

Attaphila fungicola W. M. Wheeler

1900. *Attaphila fungicola* Wheeler, Amer. Nat., xxxiv, p. 860, figs. 3 to 6. [♂, ♀, juv.; University of Texas [at Austin], Texas.]

1917. *Attaphila fungicola* Hebard, Mem. Amer. Ent. Soc., No. 2, p. 214, pl. X, figs. 5 and 6.

This distinctive insect, which is very small, brachypterous in the male sex but apterous in females, is known only from the large series originally secured in nests of the ant, *Atta fervens* Say, by Dr. Wheeler.

POLYPHAGINAE

Arenivaga bolliana (Saussure) (Pl. XII, figs. 3, 4, 5.)

1893. [*Homoeogamia*] *bolliana* Saussure, Rev. Suisse Zool., I, fasc. 2, p. 298. [♂, [probably Dallas], Texas.]

1917. *Arenivaga bolliana* Hebard, Mem. Amer. Ent. Soc., No. 2, p. 223, pl. IX, figs. 3 to 5.

In 1917 I placed as a synonym Caudell's variety *nigricans,* described from the Esperanza Ranch, Texas, in 1904, since that name was based on material merely representing a striking color phase.

Eight ♂, 10 ♀, taken II, 23 to X, 23, (and XII, 12 at Brownsville) and one immature are from Austin,* Luling,* New Braunfels, San Antonio, Sarita, Point Isabel (in dry earth under bush),

Brownsville, Cameron County, Uvalde, Sonora (in light trap), Winter Haven and Dimmit County.

This, much the largest species of the genus, inhabits litter on the ground and particularly the nests of rats, *Neotoma* sp. Abundant in central Texas east of the Pecos River, but particularly so in the southern portion of the State, I recorded *bolliana* from twenty Texan localities in 1917. Prior to that time it had regularly been referred to *Homoeogamia* in the literature.

It occurs east to Victoria, Waco and Dallas, and north to the latter locality, Bosque County, Kerrville, Sonora and the Pecos High Bridge. Though not widely distributed in Mexico, it is certainly present in the northeastern portion of that country adjacent to central Texas.

Saussure and Zehntner were again incorrect in giving "N. Mex. and Texas" for *bolliana* in the Biologia, if the former refers to New Mexico, in which State I am certain the species does not occur.

Arenivaga grata Hebard

1920. *Arenivaga grata* Hebard, Trans. Amer. Ent. Soc., XLVI, p. 203, pl. VII, figs. 3, 4. [♂, ♀; San Lorenzo, Coahuila; Kits Peak Rincon, Baboquivari Mountains, Arizona.]

Juniper Canyon in the Chisos Mountains, VII, 8 to 21, 1928, (F. M. Gaige; at light from scrub-oak forest; under stones in upper canyon; under rocks in pine-oak forest; from oak-manzanita forest along dry stream-bed), 12 ♂, 1 ♀, 1 juv. ♀.* Upper Juniper Spring in the Chisos Mountains, VII, 18, 1928, (F. M. Gaige), 1 ♂.*

This species, hitherto known in the United States only from the Baboquivari Mountains in Arizona, represents an unexpected addition to the Texan fauna. The material recorded above, compared with a hitherto unreported series of 81 males from the Baboquivari Mountains,* is found to average slightly smaller and considerably darker in coloration, but to agree closely in details of the concealed male genitalia. The cephalic margin of the pronotum in both series is broadly bordered with buffy; but in the Arizona specimens the disk averages paler, with caudo-lateral areas generally distinctly paler than the center, the general aspect being that of a pale-bordered pronotum with a dark median area sending

a pair of dark lateral rays to the outer angles. In the Texas specimens the central dark area is more extensive, and the caudolateral areas are in most instances a deep, rich reddish-brown contrasting but slightly with the median patch; the general aspect here is that of a solidly dark pronotum with broad, pale anterior margin. The palest Arizona specimens (with pronotum almost uniformly yellowish-brown) differ strikingly in appearance from the darkest Texas specimens, but the variation found in both series almost bridges the gap.

Arenivaga erratica Rehn

1903. *Homoeogamia* (*Arenivaga*) *erratica* Rehn, Proc. Acad. Nat. Sci. Phila., 1903, p. 187. [♂; Prescott, Arizona.]

1920. *Arenivaga erratica* Hebard, Trans. Amer. Ent. Soc., XLVI, p. 208, pl. VII, figs. 6, 7 and 14.

Of the Texan material recorded as *erratica* by the author in 1917 only that from Hackberry Creek, the Chisos Mountains and El Paso was correctly assigned, the balance of the series representing the then unrecognized *tonkawa*.

Thirty-one ♂, 2 ♀, taken between III, 1–15 and X, 15–27, and 2 immature individuals, are from Pecos,* the foothills west of the Ord Mountains, Fort Davis at 5000 feet,* the S. G. Ranch in Brewster County,* Valentine, Presidio (one ♂ with unusually intensive coloration, the pronotal markings being as dark, solid and extensive as is normal for *A. genitalis* Caudell) and El Paso.

The species should be found over all of Texas west of the Pecos River, as eastern known limits are Rancho del Monte in Santa Fé County, New Mexico, and Pecos and Hackberry Creek, Texas.

Arenivaga tonkawa Hebard

1917. *Arenivaga erratica* Hebard (in part not of Saussure, 1893), Mem. Amer. Ent. Soc., No. 2, p. 231, pl. IX, fig. 13. [Material from eighteen localities in Texas east of the Pecos River.]

1920. *Arenivaga tonkawa* Hebard, Trans. Amer. Ent. Soc., XLVI, p. 210, pl. VII, figs. 8 and 9. [♂, ♀; type locality—Carrizo Springs, Texas.]

This species was recorded as *Homoeogamia bolliana* Saussure by Rehn in 1902 and in 1903 from Austin and Round Mountain and by Caudell in 1904 from the Esperanza Ranch near Brownsville.

Thirty-two ♂, 10 ♀, taken II, 5 to X (except specimens from the Brownsville Region also secured XII, 24) and 25 immature

individuals are from Dallas County, Maypearl, Fort Worth, Abilene (one immature in prairie dog hole), Austin,* Travis County,* Hays County, San Antonio, Karnes County, Sarita, Esperanza Ranch near Brownsville, Brownsville, Weslaco, Hidalgo County (♂ in light trap), Sutton County, Uvalde, Winter Haven, Dimmit County (♂ in light trap) and Eagle Pass (♂ at light at night).

The size variation in this species is very great. In my series the extremes in this respect are from Dimmit County.

The distribution of the insect extends east to Goliad, Austin, Georgetown, Waco, Maypearl and Dallas County, Texas; north to the latter locality and to Murray County * and the Wichita Mountains,* Oklahoma, and Abilene, Texas; west to the latter, and Abilene and Devils River, Texas. It undoubtedly occurs over a considerable area in adjacent northeastern Mexico, but is there as yet known only from Nuevo Laredo, Tamaulipas.

Eremoblatta subdiaphana (Scudder)

1902. *Homoeogamia subdiaphana* Scudder, Proc. Davenport Acad. Sci., IX, p. 19. [♂; Las Cruces, New Mexico.]

1917. *Eremoblatta subdiaphana* Hebard, Mem. Amer. Ent. Soc., No. 2, p. 240, pl. IX, figs. 17 to 20.

Sierra Blanca, VII, 8, 1919, 1 ♂, [Cornell Univ.]. Presidio, V, 15 to IX, 23, 1928 to 1930, (E. R. Tinkham), 6 ♂, 1 ♀, 1 juv. ♂. Castolon, IV, 23 and VI, 1, 1928, (F. F. Bibby), 3 ♂. El Paso, VI, 28, 1921, (C. D. Duncan), 2 ♂, [Cal. Acad. Sci. and Hebard Cln.].

The above are northeastern limits for the species which is found westward through the more arid sections of the southwestern United States to the eastern base of the Laguna Mountains in southern California and is undoubtedly widely distributed in adjacent northern Mexico.

MANTIDAE

Nine Mantid species are found in Texas. Three of these are tropical in origin; two are confined to the Brownsville Region, the other occurring through western Texas. Three are southeastern (one of these likewise present in the American tropics), their distribution covering a large part of all excepting west Texas but in each case having very different boundaries. Three are western

species, one being found over most of Texas, the other two confined to the western portion of the State.

The family is comparatively small, reaching its optimum development in the Tropics and never present in truly boreal regions. Only in extreme southern Arizona are more species to be found at the same locality, where the maximum, six, are present in the Baboquivari Mountains and probably in other adjacent ranges, than in some parts of Texas.

All Mantids are carnivores, living almost exclusively on other insects. All are, therefore, beneficial instead of harmful. None of the species ever approach the numerical abundance of the great majority of those of the other Orthopteran families.

1. Cephalic tibiae with a row of closely placed short similar spines on each ventral margin and lacking a dorso-distal internal spine. Dorsal margin vertex without juxta-ocular protuberances. (Male with both antennae and costal margin of tegmina and wings not ciliate.) 2

   Cephalic tibiae with two outer and one inner elongate spines on ventral margins, the former preceded by microscopic teeth and with an elongate dorso-distal internal spine. Dorsal margin of vertex with a small but prominent rounded juxta-ocular protuberance. (Cephalic femora comparatively very elongate and slender. Size small and form very slender for family. Male with fully developed organs of flight; female apterous. Generally buffy brown to dark brown. Pronotum very elongate and slender even for this family, with rounded-angulate expansion rather sudden and collar very slender. Supra-anal plate elongate triangular in both sexes. Pronotal lateral margins minutely microscopically denticulate.) 8

2. Size small, form relatively broad for family. Pronotum short, its expansion not strong and very gradual. (Antennae very slender, simple; in male sub-ciliate. Cephalic femora comparatively robust. Generally buff to dark brown. Supra-anal plate rounded triangular in male, very broadly convex to broadly bilobate in female. Lateral margins of pronotum smooth to finely denticulate) 7

   Size medium large to very large. Pronotum relatively more slender with expansion more sudden (this least decided in *Stagmomantis limbata*) .. 3

3. Head without a frontal process. Median and caudal tibiae not carinate. Cephalic femora not undulate 4

   Head with a very prominent frontal process, formed by two adjacent parts which spring from the interocellar area and in length approximate the width of the head. Median and caudal tibiae heavily carinate. Cephalic femora slender and undulate. (Eyes roundly protuberant. Antennae of male bluntly serrulate-moniliform, of female very small and moniliform.

Pronotum very elongate and rather sudden expansion situated near cephalic extremity, lateral margins serrulate (this weakest on shaft, particularly in male). Organs of flight fully developed; in male caudate with dorsal fields vitreous except in distal portion, in female subcaudate, opaque with very broad lateral field suddenly terminating meso-distad. General color green, brown and yellow; male with brown flecks in opaque distal portion of tegmina, female with two transverse brown suffusions in dorsal fields. Wings of male largely clear vitreous, of female largely transparent brown. Cephalic coxae blackish disto-internally.) In tropical vegetation of Brownsville Region.

9. *Phyllovates chlorophaea* (Blanchard)

4. Antennae very slender, simple, smooth. Cephalic femora moderately stout with more normal spination (four discoidal and four ventro-external spines). Pronotum moderately elongate with moderately pronounced expansion meso-cephalad, lateral margins feebly denticulate. Dorsal margin of occiput feebly convex between eyes. Limbs moderately elongate, caudal metatarsus near combined length of succeeding joints. Male moderately slender, female much more robust. Organs of flight fully developed in male, considerably reduced in female. (Green, buff and brown, uniform or tessellate color phases occur. Tegmina of male hyaline in dorsal portion or wholly so, of female opaque.) 5

Parthenogenetic and male not known for this North American species. Antennae thick with extremely short joints, ciliate, in part moniliform. Cephalic femora very slender and elongate with three discoidal and five ventro-external spines. Pronotum very elongate with weak expansion near cephalic extremity, lateral margins conspicuously blunt denticulate. Very slender with tegmina greatly reduced to small overlapping pads. Dorsal margin of occiput more definitely convex between eyes. Limbs very elongate, caudal metatarsus much longer than combined length of succeeding joints. Female very slender with tegmina greatly reduced to small overlapping pads. (Green with tegmina purplish brown and a medio-longitudinal yellow-buff band on abdomen dorsad which has a yellow median line.) Tall grass in marshes of east Texas.

8. *Brunneria borealis* Scudder

5. Expansion of pronotum less gradual and less decided. Marginal field of male tegmina hyaline or opaque but differently colored, of female comparatively narrow 6

Expansion of pronotum more gradual and more decided. Marginal field of male tegmina opaque, uniform green with a narrow internal white margin, of female broader. (Dorsal surface of abdomen of uniform color in both sexes.) In herbage, usually in more arid environment of south and west Texas.....7. *Stagmomantis limbata* (Hahn)

6. Dorsal surface of abdomen of uniform color in both sexes. Marginal field of male tegmina hyaline, colorless or evenly tinged with brown. Eyes averaging less prominent. Wings never suffused with dull pinkish at base. In herbage of east, central and south Texas.
5. *Stagmomantis carolina* (Johannson)

Dorsal surface of abdomen pale with striking transverse bands of shining blackish brown proximad. Marginal field of male tegmina individually hyaline and tessellate, or opaque whitish or greenish white or green and feebly to heavily tessellate with brown. Wings almost always suffused with dull pinkish at base. In desert vegetation of west Texas.
6. *Stagmomantis californica* Rehn and Hebard

7. Eyes roundly projecting with margin of head between them transverse. Organs of flight fully developed to greatly reduced in both sexes. Caudal femora not definitely thickened in proximal half. Caudal metatarsus elongate, almost to over combined length of succeeding joints. Terrestrial. Over all but east Texas...1. *Litaneutria minor* (Scudder)

Eyes strongly conical projecting dorso-laterad with margin of head between them concave. Caudal femora slightly but definitely thickened, giving greater saltatorial power. Caudal metatarsus short, shorter than combined length of the two succeeding joints. Terrestrial. In open in west Texas.....2. *Yersiniops solitarium* (Scudder)

8. Elongate and slender. Cephalic coxae reach beyond caudal margin of prosternum. Pronotal expansion mesad in male, moderately cephalad of mesad in female. Male with organs of flight wholly concealing distal portion of abdomen or leaving a brief portion exposed. Largely terrestrial. All of Texas except extreme western and extreme southern portions.....3. *Oligonicella scudderi* (Saussure)

Very elongate and very slender. Cephalic coxae fall considerably short of caudal margin of prosternum. Pronotal expansion moderately cephalad of mesad in male, mesocephalad in female. Male with organs of flight leaving more of distal portion of abdomen exposed. Terrestrial. Brownsville Region..4. *Oligonicella mexicana* (Saussure and Zehntner)

Little has been said concerning the leaping powers of the Mantidae. Though in the genus *Yersiniops* the caudal femora show some slight enlargement in their proximal portions, those members appear delicate and quite unfit for actual leaping in most species of this Family. This I have seen to be far from fact through observation of small immatures of *Tenodera sinensis,* less than an inch long. Without the slightest apparent preparatory movement they can leap well over twice their own length with surprising agility and accuracy. It is therefore inaccurate, indeed in many cases false, to term the Mantidae "Non-saltatorial Orthoptera."

AMELINAE

Litaneutria minor (Scudder)

1872. *Stagmatoptera minor* Scudder, U. S. Geol. Surv. Nebraska, Final Rept., pt. 3, p. 251. [Adults; Nebraska City, Nebraska.]

1935. *Litaneutria minor* Hebard, Trans. Amer. Ent. Soc., LXI, p. 275. (Synonymy and discussion of variation.)

The species was reported from Texas by Scudder in 1896, from Blanco County and Shovel Mount by Rehn in 1903 and from El Paso and the Franklin Mountains at 5000 feet, as the synonym *skinneri,* by Rehn and Hebard in 1909.

Seventy-one ♂, 35 ♀, taken from IV, 13 to XI, 12, and 27 immatures, are from Maypearl (scarce), Weatherford (beaten from weeds), Hood County, Dundee,* Cisco (on hill slope on rocks and in very short grass), Waco, Aransas County, Corpus Christi (macropterous male attracted to light at night), Lyford (beaten from weeds in Mesquite thicket), Point Isabel, Laguna del Gato, Austin, Shovel Mount, Llano, Comfort, Kerrville, San Antonio (macropterous male attracted to light at night), Pearsall, Cotulla, Laredo, Carrizo Springs, Brackettville, Eagle Pass (on ground), Juno, Del Rio, Shamrock, Happy Crossing in Palo Duro Canyon in Randall County, Lubbock (running on ground on plain), Midland (occasional on plains), Chancellor, Pecos, Marathon (not common on rocky ground among bushes), Double Windmill, Bone Spring (at light at night), Dog Canyon, Neville Spring, Glenn Spring in Chisos Mountains (at light at night from mesquite-catclaw-greasewood flat; at light at night from creosote bush-greasewood-mesquite flat),* Moss Well in Chisos Mountains (few on stony ground up to 5000 feet), Juniper Canyon in Chisos Mountains (on ground in lower canyon; on ground and at light in oak-pine-juniper forest; on trunk of oak in upper canyon; in the Basin at 6500 feet),* Canyon behind Pulliam Bluff in Chisos Mountains, Boquillas (from Mesquite flat on Tornillo Creek at the Rio Grande),* Marfa, Presidio, Frijole, Kent (on limestone plateau), Phantom Lake in Davis Mountains (on ground in red hills),* Lower Limpia Canyon in Davis Mountains, Valentine, Van Horn (on ground), Sierra Blanca (on bare adobe), foothills of Puertacitas Mountains at 5100 feet, El Paso at 4524 feet and Franklin Mountains at 5000 feet.

In this series five brachypterous males are from Happy Crossing, Marfa, Van Horn and El Paso. The largest and smallest females

are 33.4 (Shamrock) and 22.7 (Carrizo Springs) mm. in length. Decided individual variation in degree of robustness is also shown. It is noteworthy that in the earlier stages the eyes are quite sharply conical dorso-laterad.

Usually marvelously concealed by their coloration when motionless, these diminutive mantids are able to run with great agility.

The distribution of *minor* includes all but eastern Texas, eastern limits being Maypearl, Waco, Austin and Aransas County. Other eastern limits are Fort Sill and Cherokee, Oklahoma; McPherson and Reno County, Kansas; (locally in) Plymouth and Johnson [16] Counties, Iowa; Capa, South Dakota; Medora, Amidon and Sentinel Butte, North Dakota. Northern limits are the latter, Forsythe and Havre, Montana, and Osoyoos, British Columbia. The species occurs westward to the latter locality; Longmires, Washington; [16] Montague, California [16] and south of that point extends to the coast.

Yersiniops solitarium (Scudder)

1896. *Yersinia solitaria* Scudder, Canadian Ent., XXVIII, p. 209. [♂, ♀; Plains at base of Rocky Mountains and Garland at about 8000 feet, Colorado.]

1929. *Yersiniops solitarium* Hebard, Trans. Amer. Ent. Soc., LVII, p. 114. (Generic analysis.)

Lower Limpia Canyon, Davis Mountains, 5150 to 5250 feet, VIII, 31, 1912, (M. Hebard), 1 ♂, 1 ♀. Slopes of Pine Mountain, Davis Mountains, one at 6800, others at 7000 feet, VIII, 29, 1912, (Rehn and Hebard; on rocky slope among scattered bunch grass in oak zone, common on ground among grasses in pasture), 6 ♂, 6 ♀, 1 large juv. ♀; X, 3, 1931, (E. R. Tinkham), 1 ♀. Livermore Peak, Davis Mountains, 7500 to 8200 feet, VIII, 30, 1912, (Rehn and Hebard; three in grasses of meadows at summit), 3 ♂, 3 ♀.

These are first records for Texas and represent a southeastern limital area in the distribution of the species. It is found East to Trinidad, La Junta and Austin Bluff near Colorado Springs, Colorado: North to the latter, Garland, Animas and Mancos, Colorado: West to the latter, Jemez Hot Springs, New Mexico, and the Santa Rita Mountains,[17] Arizona. It will undoubtedly be found in adjacent northern Mexico.

[16] Previously unreported material in the author's collection.
[17] Material before me.

Usually found singly on the ground, this diminutive flightless mantid is able not only to run rapidly but leap quite vigorously as well.[18]

OLIGONICINAE

Oligonicella scudderi (Saussure)

1870. *Oligonyx scudderi* Saussure, Mitt. Schweizer Ent. Gesell., III, p. 239. [♂ North America [Georgia].]

1916. *Oligonyx scudderi* Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1916, p. 122. (Synonymy and discussion.)

1931. *Oligonicella scudderi* Hebard, Proc. Acad. Nat. Sci. Phila., LXXXIII, p. 128. (Synonymy and distribution.)

The species was recorded from Texas by Stål in 1877, from Shovel Mount by Rehn in 1903 and from College Station by Hart in 1906.

Twenty ♂, 3 ♀, taken from III, 26 to XI 2, 4 immatures and 1 ootheca, are from Dickinson (9 pale ♂), Hearne (dark ♂), College Station (2 ♂ pale, one dark), Chesterville, Dallas (dark ♂ in old field, pale immature ♂), Gregory (pale immature ♂ in dry yellow grass among Mesquites), Austin,* Cisco (moderately dark ♂ beaten from oaks), Mountain Home, San Antonio (pale ♂), Laredo, Carrizo Springs (2 ♂ pale, one dark), Knickerbocker, Canadian at 2400 feet (on flat above river level, by beating), Marathon (pale immature ♂, in low bush on hill), the Chisos Mountains and Marfa.

These Texan specimens average distinctly more elongate and slender than those from Nebraska and Kansas before me.

This is a comparatively scarce insect which I believe appears adult in largest numbers late in the season. It may however be double brooded in southern Texas, from which region eight adults of the present series were taken from March to June.

Its distribution includes all of Texas excepting the northwestern portion of the Pan-Handle, the extreme western section and the Brownsville Region.[19]

[18] Note—Wood-Mason "On a Saltatorial Mantis," *Trans. Ent. Soc. London*, 1878, pp. 268 to 269. ("an *Ameles* allied to *spallanzania* from Portugal.")

[19] Scudder and Cockerell's record from La Trementina in the Organ Mountains of New Mexico can not be verified and should not be used until further material shows definitely which species occur there. Their specimen can not be located and error in determination is strongly suggested.

Oligonicella mexicana (Saussure and Zehntner)

1894. *Oligonyx mexicanus* Saussure and Zehntner, Biol. Cent.-Amer., Orth., I, p. 172, pl. IX, figs. 13 to 15. [♂: Presidio, Mexico; Cubulco, Vera Paz, Guatemala.]

1931. *Oligonicella mexicana* Hebard, Proc. Acad. Nat. Sci. Phila., LXXXIII, p. 128, footnote 11. (Corrections and United States records.)

1932. *Oligonicella mexicana* Hebard, Trans. Amer. Ent. Soc., LVIII, p. 211. (Corrections and Mexican records.)

This insect was reported from the Esperanza Ranch near Brownsville by Caudell in 1904 and from Brownsville by Rehn in 1907 as *Bactromantis virga,* a name established as a synonym of *Stagmomantis carolina* by Rehn and Hebard in 1916.

Brownsville, IV, 1911, (G. Dorner), 10 ♂, 1 ♀; VI, (F. H. Snow), 1 ♀. McAllen, VII, 27, 1928, (F. M. Jones), 1 ♂.

The species occurs in Texas only in the Brownsville region, but is widely distributed in southeastern Arizona and northwest to Dewey and Avondale. It is known to have a very extensive distribution in Mexico and has been recorded from as far south as Guatemala.

MANTINAE

Stagmomantis carolina (Johannson)

1763. *Gryllus carolinus* Johannson, in Linnaeus, Amoenit. Acad., VI, p. 396. [♀, Carolina.]

1935. *Stagmomantis carolina* Rehn, Proc. Acad. Nat. Sci. Phila., LXXXVII, p. 233, pl. 7, figs. 20 and 21, pl. 10, figs. 1 and 2. (Synonymy and general revision.)

The species has been recorded from Texas correctly and as the synonymous *tolteca, stollii, dimidiata* and *simplex.* It was reported from Washington County and Shovel Mount in 1903 and from Brownsville in 1907 by Rehn.

Fifty-two ♂, 28 ♀, taken from VIII, 13 to XII, 5 (but in the Brownsville region as early as June), and 86 immature individuals are from Marshall (immatures in weedy meadow),* Longview, Beaumont, Sabine (on grassy tidal flats), Liberty,* Palestine, Elkhart, Houston, Harrisburg (in grasses and vines of Short-Leaf Pine woods), Webster (on grassy prairie), La Marque (same), Virginia Point (in salt marsh), Hearne, College Station, Waller, Rosenberg, Denton, Dallas (immatures common on prairie

on August 14, pair in coitu on upper sprays of Mesquite on IX, 26; adults in willows and tall weeds in gully),* Cedar Hill on Day Ranch in Dallas County, Waxahachie, Fort Worth,* Weatherford (beaten from weeds), Worth Ranch in Palo Pinto County, Breckenridge (immatures on mesquite-scrub oak flat),* Cisco (♀ mottled dark brown, strikingly resembling tree trunk on which it was found), Albany (immatures common on grassy plain with scattered Mesquite),* Shovel Mount, Austin, Premont, Esperanza Ranch near Brownsville, Brownsville (in chaparral and in pasture), Alleyton (immatures scarce in dry, oak-covered red clay hills),* Flatonia (occasional in bunch grass in Post Oak forest), Victoria, San Antonio, Dunlay Hill in Medina County (immatures few in thorny scrub),* Derby, Cotulla (on Mesquite), Uvalde, Carrizo Springs (unusually pallid male), Del Rio (in thorny scrub, Mesquite, weed field),* Canadian (brushy hillside), Shamrock,* Clarendon, Childress (in old fields), Spur, Dalhart (in weeds), Canadian River north of Amarillo, Palo Duro Canyon in Randall County, Lubbock (in heavy weeds), and Coahoma (immatures common on dry Mesquite plains).*

Among the females green, brown and buffy, highly mottled or almost uniform color phases are represented. The greatest differentiation is, however, shown by the series from the Brownsville region, where individuals range from somewhat below normal size to amazingly depauperate. From no other part of the exceedingly extensive distribution of this species is such extreme depauperation known. Such material before me in length measures: ♂ 35.5, ♀ 38.7, the largest ♂ 48, ♀ 47.7, whereas the other Texan series range as follows: ♂ 45 to 59.7, ♀ 51.2 to 60 mm. Accompanying this depauperation distinctly greater slenderness is shown, but there is too much individual variation generally occurring in the species to permit recognition here even of a geographic race. Two of the most depauperate males before me were recorded as *Callimantis floridana* Scudder, by Caudell in 1904.

The resemblance of individuals to their immediate surroundings is often amazing. The species appears adult in most of Texas late in the season, full grown individuals being more numerous in late September and October than at any other time. The presence of adults in the Spring in the Brownsville region indicates a different life cycle in that subtropical environment.

Widespread in the eastern United States except in its northern portions, the species is present in all but the southwestern portion of Texas, western known limits being Canyon City, Colorado; Dalhart, Texas; Cameo, New Mexico, and Coahoma,* Shovel Mount and Del Rio, Texas.[20]

It should be found on the Edwards Plateau, but I am satisfied that in Trans-Pecos Texas it is wholly supplanted by *limbata* and *californica*. To the south it is present only in a comparatively narrow eastern border of northern Mexico, but in Central America and northern South America its range again becomes much more extensive.[21]

Stagmomantis californica Rehn and Hebard

1909. *Stagmomantis californica* Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1909, p. 416, figs. 1 and 2. [♂, ♀; Cottonwood, San Bernardino County, California.]

1935. *Stagmomantis californica* Hebard, Trans. Amer. Ent. Soc., LXI, p. 277. (Arizona records.)

Hackberry Creek in Brewster County, 3160 feet, IX, 2, 1912, (Rehn and Hebard; attracted to light at night), 3 ♂. Dog Canyon in Brewster County, IX, 3, 1912, (Rehn and Hebard; attracted to light at night), 6 ♂. Canyon behind Pulliam Bluff in Chisos Mountains, 4600 feet, IX, 7, 1912, (Rehn and Hebard; in low plants and grasses in valley), 1 ♀. Presidio, IX, 1, 1929, (E. R. Tinkham), 1 ♂. Kent, 3800 feet, IX, 17, 1912, (Rehn and Hebard; in low desert brush), 1 ♂, 1 ♀. El Paso, 3700 feet, IX, 16, 1912, (Rehn and Hebard; beaten from rabbitweed on river flat), 1 ♂; XI, 1887, (L. Bruner), 1 ♂.

Found only in Trans-Pecos, Texas, eastern limits for this species are Melena in Chaves County [22] and Carlsbad,[22] New Mexico; Kent, Hackberry Creek, Dog Canyon and the Chisos Mountains, Texas. Northern limits are Melena, New Mexico; Grand Junction, Colorado; Leeds [22] and the Beaver Dam Mountains,[22] Utah; Glendale in Clark County,[22] Indian Spring [22] and Millers,[22] Ne-

[20] Material recorded as *carolina* from Las Cruces and Mesilla Park, New Mexico, by Scudder and Cockerell in 1902 actually represents *S. californica* R. & H. The latter locality was repeated by Rehn, from the literature, in 1935. That same year I noted that all records of *carolina* from Arizona are erroneous.

[21] See Rehn, Proc. Acad. Nat. Sci. Phila., LXXXVII, pp. 233 to 240, (1935).

[22] Material collected by Rehn and Hebard.

vada; Silver Canyon in White Mountains in Inyo County at 6000 feet [22] and Bakersfield,[22] California, and south but near the coast at Roscoe in the Tejunga Wash in Los Angeles County,[22] California.

Stagmomantis limbata (Hahn) (Pl. XIII, figs. 7, 8.)

1836. *"Mantis limbata* Hahn, Icon. Orth., pl. A, gen. Mantis, fig. 2." [♂, Mexico.]

1870. *Stagmomantis limbata* Saussure, Miss. Sci. Mex., Rech. Zool., VI, p. 249, fig. 11 (♀ in color). (Discussion of material from Mexico and Guatemala.)

1935. *Stagmomantis limbata* Hebard, Proc. Acad. Nat. Sci. Phila., LXXXVII, p. 49. (Data for material from Northern New Mexico at 7000 feet.)

The species was recorded from Ringgold Barracks by Scudder in 1896 and from Shovel Mount by Rehn in 1903.

Fifty-four ♂, 25 ♀, taken from VIII, 19 to X, 27 (except a ♀ from Brownsville on XI, 29), 20 immature individuals and 4 oothecae are from Beeville, Karnes County, Lyford, Brownsville, Floyd County (on Staked Plains), Happy Crossing in Palo Duro Canyon in Randall County (few in Bear Grass and low bushes on upper slopes of canyon walls at 3400 to 3500 feet), Uvalde, Sanderson (ootheca), Marathon (in bushes), Glenn Spring in Chisos Mountains (small immatures June 24),* Moss Well in Chisos Mountains at 4800 feet (♀ taken at night clinging to petiole of Sotol with head toward stalk), Canyon behind Pulliam Bluff in Chisos Mountains at 4600 to 5000 feet (on low plants and in grasses on floor of valley), western foothills of Ord Mountains, the S. G. Ranch in Brewster County (at light at night),* Fort Davis,* Phantom Lake in Davis Mountains (in weeds along arroyo),* Kent (in low desert bushes, but particularly in low gray-green leaved aromatic species), Chinati Mountains, Presidio, Sierra Blanca at 4700 feet, Quitman Mountains at 5000 feet (a largely green ♂ in a green bush), Frijole,* Franklin Mountains at 4000 feet and El Paso (beaten from rabbit weed on river flats).

Widespread in Mexico and recorded from Guatemala as well, this species extends its distribution into western Texas as far east as Brownsville, Lyford, Beeville, Shovel Mount and the Staked Plains in Floyd County. Northern limits are the latter and Palo Duro Canyon, Texas; Las Vegas (recorded as *carolina* by Scudder

and Cockerell, a female in the author's collection), Rancho del Monte near Santa Fé at 7000 feet and Fort Wingate, New Mexico; Ash Fork, Kingman and Topock, Arizona (from the author's collection). The latter locality, Needles and Calexico, California (material from the same source) are known western limits.

There is every reason to believe that *Phasmomantis sumichrasti* Saussure must not be considered a member of the Texan fauna. Saussure and Zehntner recorded this species from "Texas" in 1894, but that was almost certainly due to an error in labeling. The species was described from Cordoba, Vera Cruz and has subsequently been recorded from San Rafael and Orizaba in Vera Cruz; Tehuantepec, and Merida, Valladolid, Temax and Chichen Itza in Yucatan, Mexico; British Honduras, and San Cristobal in Vera Paz, Guatemala. A single species of *Tauromantis,* a related genus, occurs in Costa Rica.

PHOTININAE

Brunneria borealis Scudder

1896. *Brunneria borealis* Scudder, Canadian Ent., XXVIII, p. 212. [Juv. ♀, Gulf Coast of Texas.]

Thirty-three ♀ taken VII, 18 to X, 31, and 79 immature ♀ are from Marshall (1 ♀ and 22 large and medium-sized immatures swept from tall grass and weeds July 18),* Longview (few in high grasses in open), Palestine (two in areas of high grass), Edom in Van Zandt County, McWhorter's Ranch, near Waxahachie, Brazoria County, Sabine (rare in grasses on marsh (but not tidal) flats), College Station, Houston, Harrisburg (occasional in high grasses), Webster (in low plant on prairie), La Marque (scarce on prairie), Virginia Point (abundant for a mantid (15 adults and 26 nearly full grown immatures), well distributed in marsh grass about two feet high), Rosenberg, Rock Island, Port Lavaca and Victoria (in high weeds in field).

These large, very elongate and almost apterous insects are usually found resting horizontally in high grass about a foot or more from the ground. When approached they climb away quite vigorously through the grass but can be taken easily as they never climb downward to hide.

The large series now before me includes exclusively females and the species is evidently parthenogenetic. All of the other species of the genus are South American, but in those the macropterous males are as frequently found as the highly brachypterous females.

It is probable that adults of *borealis* appear about the middle of July, but are present in greatest numbers in late September and during October.

These are the first definite Texan records for the species which have been published. I have it also from Shreveport, Le Bleu settlement in Calcasieu Parish and Arcadia, Louisiana; St. Elmo, Irvington and Mobile, Alabama; Pensacola, Florida, and Vidalia, Georgia,[23] while it was recorded by Brimley in 1938 from Washington and Raleigh, North Carolina. This drift eastward into central Georgia of western species is now also known for *Campylacantha olivacea olivacea* (Scudder) and *Melanoplus impiger* Scudder, but it is surprising to find that the present insect then swings northeastward far into North Carolina.

VATINAE

Phyllovates chlorophaea (Blanchard)

1835. *Mantis chlorophaea* Blanchard, Mag. Zool., Ins., V, classe IX, pl. 135. [♀; Watertown, New York (in error).] [24]

1896. *Theoclytes chlorophaea* Scudder, Canadian Ent., XXVIII, p. 213. (Agreeing with Saussure that original reference was probably incorrect. Recording a specimen from Matamoros, Tamaulipas.)

1935. *Phyllovates chlorophaea* Rehn, Proc. Acad. Nat. Sci. Phila., LXXXVII, p. 267. (References, Costa Rican records and distribution.)

Brownsville, VI, (F. H. Snow), 1 juv. ♂.

This specimen was recorded by Rehn in 1907 as *Theoclytes chlorophaea.*

The species is the most abundant of the Vatinae in tropical North America and is found on the Pacific coast north to the southern portion of Sinaloa and south to northern Colombia in South America. I believe that in the United States it will be found only in the subtropical river bottom-land environment near the mouth of the Rio Grande.

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[23] All of this material secured by Rehn and Hebard, except that from Georgia which was taken by H. Fox.

[24] Saussure's record of this species from Louisiana in 1869 is almost certainly erroneous.

Phasmidae

This family is represented in Texas by thirteen wholly apterous species and races, of which all but one are slender to different degrees. Males of these species are all much smaller with much more slender bodies than females. The cephalic femora in all are curved proximad opposite the head.

Of the species six may be said to be southern, one southwestern and two each eastern, central and western, though a species and a race placed as southern have not as yet been taken outside of Texas. Reaching much their greatest diversity and numbers in the tropics, the number of Phasmid species as well as their general numerical abundance rapidly diminishes northward, and it was to be expected that many more forms would be present in the southern than in the northern portions of the State.

Only one of these species, *Diapheromera femorata,* may be considered arboreal, the others being usually found in grasses, low herbage or in bushes. Only two species, *Diapheromera velii* and *femorata,* are known to appear locally (but infrequently) in such large numbers that they can do considerable damage to the vegetation upon which they feed, but several other species have been found rarely and very locally in exceptional abundance.

All are slow and clumsy in their movements, placing a fully justified reliance in their amazing resemblance to their environment by usually becoming rigid and motionless when approached.

1. Form comparatively robust for this family of slender species, mesonotum considerably less than three times as long as pronotum. Median and caudal tibiae with a distal triangular impression on ventral surface.[25] Length of median segment (feebly defined dorsad) laterad approximating that of metanotum. (Antennae moderately stout and elongate. Limbs unarmed. Male exceptionally smaller and less robust than female. Coloration light brown with three darker longitudinal dorsal bands which are usually very poorly defined; the median band not broad, frequently subobsolete, largely obsolete or very extensively interrupted.) In vegetation near ground. East Texas.
1. *Anisomorpha ferruginea* (Beauvois)

Form moderately to extremely slender, mesonotum four or more times as long as pronotum. Median and caudal tibiae lacking disto-ventral impression. Length of median segment many times less than that of metanotum.....2

[25] Redtenbacher gives the "metatarsus" elongate for that section of his key in which the present species falls. This is incorrect, as in this species the metatarsus is rather short in males, very short in females.

2. Antennae very short, considerably less than half as long as cephalic femur in male, decidedly shorter in female. (Male extremely slender, female somewhat more robust. Surface smooth. Caudal metatarsus very elongate, approximately twice length of succeeding joints in male, proportionately somewhat shorter in female. Male penultimate (ninth) tergite fully twice as long as its greatest width; poculum strongly emarginate at apex. Male cercus with a proximo-internal flange which is produced in a tooth. Generally buff or light brown, a medio-longitudinal dark dorsal band which weakens on head and last tergites often conspicuous in male, individually varying to weak, thus but varying to obsolete in female; a post-ocular dark line similarly indicated. In grasses. West Texas.....2. *Parabacillus coloradus* (Scudder)

Antennae very elongate and slender, much longer than cephalic femur, particularly in male.....3

3. Median femora simple, unarmed. Male extremely slender, female somewhat more robust. Male cercus unarmed proximad with apex trifid. Male with ninth sternite produced as a free, elongate, closed, tubular process with very small poculum at its apex. (Surface of male smooth, of female longitudinally multicarinate. Caudal metatarsus elongate, very much longer than combined length of succeeding joints in male, proportionately slightly shorter in female.).....4

Median femora either with meso-proximal lobes or with a ventro-distal spine. Both sexes less slender. Male cercus with apex not trifid.[26] Male with ninth sternite not produced as an elongate tubular process.[26].....5

4. Male cercus moderately elongate, trifid portion occupying half total length. Male poculum evenly convex with a blunt weak dorsal lip. Female cercus straight, very short, portion dorsally exposed scarcely one-third length of penultimate tergite. Both sexes less elongate and slender. (Generally various browns and grays, often heavily overlaid with whitish, sometimes mottled. Male frequently with large portion of mesonotum, metanotum and extensive proximal portions of median and caudal femora dull light green. Head of male with a whitish dorso-lateral streak and a post-ocular weak dark suffusion, the former continued on lateral margins of pronotum and sometimes on succeeding tergites. Ground herbage.) All but east Texas.

3. *Pseudosermyle straminea* (Scudder)

Male cercus elongate, trifid portion occupying about one-third total length. Male poculum sharply produced rounded-conical with a prominent but blunt tooth above disto-mesad. Female cercus straight, very elongate, portion dorsally exposed nearly as long as penultimate tergite. Both sexes even more elongate and slender. (Light brown sometimes overlaid with whitish, varying to dark brown. Limbs of male sometimes mottled. Ground herbage.) East, central and south Texas.

4. *Pseudosermyle strigata* (Scudder)

[26] There is much evidence to indicate that the yet unknown male of *Sermyle mexicana* will agree in these features.

5. Body smooth and without longitudinal carinae. No foliaceous projections on head, body or limbs. Median or median and caudal femora with a ventro-distal meso-internal spine. Operculum with apex sharply triangular produced. Caudal metatarsus more elongate. (Male with ninth sternite very briefly closed-tubular, with ladle-like poculum attached) 6

(Adult male unknown.) Fifth abdominal tergite longitudinally lamellate, swollen in caudal portion with margins lamellate produced latero-caudad. Median femora with ventral margins bearing a foliaceous lobe meso-proximad; [27] femora lacking a ventro-distal spine. Sternites bicarinate, particularly caudad. Operculum with apex bluntly triangularly produced. Caudal metatarsus shorter, considerably shorter than combined length of succeeding joints. (Female with head short and rounded, tuberculate and with a pair of large ear-like lamellate projections above and between the eyes. Body dorsad tuberculate, particularly on thorax, but with the longest tubercles on the head. Cerci very short and blunt. Generally whitish, gray and brown mottled.) Probably a brush inhabitant. Brownsville Region.

5. *Sermyle mexicana* (Saussure)

6. Median carina of ventral surface of median or median and caudal femora armed, distad only, with a spine. Male cercus not spatulate. Size not as large and body and limbs not as heavy 7

Median carina of ventral surface of median and caudal femora strongly spined throughout. Male cercus strikingly spatulate (and with a heavy rounded proximo-internal flange). Size very large, largest of the temperate American walking-sticks. (Head short and globose, unarmed. Median (particularly) and caudal femora very heavy in male, heavy in female; all with ventro-distal spine extremely large (and elongate, particularly of caudal) in male, broad but very much shorter in female; ventro-lateral margins of femora and tibiae of these limbs serrulate. Female cercus very short. Generally light brownish-buff to dull olive brown rarely maculate with grayish; male with a broad medio-longitudinal area on mesonotum and on metanotum of dull green or dull pinkish and cephalic femora rarely dull greenish.) In vines and trees. Possibly in all but northwest Texas and as far west as Chisos Mountains, but apparently extremely local.

13. *Megaphasma denticrus* (Stål)

7. Median femora with a ventro-distal spine (prominent in male, very small in female), caudal femora unarmed. Head elongate, (unarmed). (Form very slender for genus. Median femora feebly thickened in male, not thickened in female. Cercus of male with a proximo-internal tooth; of female elongate, acute. Male poculum simple, evenly rounded distad. Generally uniform buff or light to dark brown and female often light green, head often with a weakly darker

[27] Stated by Saussure to be also the case in an immature male.

post-ocular streak which is sometimes continued more broadly caudad on body dorso-laterad.) In grasses. East, central and south Texas. 6. *Diapheromera persimilis* Caudell

Median and caudal femora armed with a ventro-distal spine (always more prominent in male than in female). Head shorter to much shorter....8

8. Form very slender for genus, as in *persimilis,* but head shorter though not as short as in the other species. Male cercus unspecialized proximo-internally. Male poculum twisted so that the simple oval plate lies almost vertically dextrad. (Male with median femur feebly thickened but ventro-distal spine heavy, caudal femur not thickened and distal spine very small. Generally reddish-brown, head and pronotum paler, the former with a post-ocular, the latter with a median suffused darker band. Immatures uniform light green; immature female similar to male in ambisexual characters, femora not thickened, the median with ventro-distal spine minute.) In brush of Oak Zone. Chisos Mountains....12. *Diapheromera torquata* Hebard

Form less slender and head shorter. Male cercus with a proximo-internal flange or tooth. Male poculum not twisted, horizontal. (Median femur of male strongly thickened. Male median and caudal femora with long ventro-distal spine, those of the former the heavier; female with these spines smaller)....9

9. Head simple, without two occipital horns. Male poculum symmetrical, directed caudad, with meso-distal section not elongate....10

Head with two occipital horns (except in male of *Diapheromera tamaulipensis*). Male poculum asymmetrical, proximal portion directed caudad, then with meso-distal section elongate and bent sinistrad, distal portion again directed caudad, with apex bilobate. (Male cercus with a minute proximo-internal spine. Female cercus short)....12

10. Head averaging slightly but appreciably longer. Male cercus with a minute sharp proximo-internal spine. Male poculum larger, convex, with dorsal margin curving strongly dorsad in lateral aspect. Head never showing a medio-longitudinal stripe, a post-ocular stripe weak or obsolete. Femora never annulate. (Male generally very light brown to dull dark brown with cephalic limbs and median and caudal tibiae of body color or rich green or greenish. Female generally light or dark brown or green.)....11

Head averaging shorter, usually (but not always) as broad as long. Male cercus with a small thick bluntly rounded proximo-internal flange. Male poculum small, oval, with dorsal margin horizontal (terminating in a very narrow even dorso-distal lip). Head pale in male with post-ocular and sometimes a medio-longitudinal stripe. Male median femora often decidedly and caudal femora less conspicuously annulate. (Cerci of female very short. Male generally light to very dark brown. Cephalic femora and tibiae and usually other tibiae (but often to a less degree) rich to dull green. Female very much more uniform, light to dark brown, rarely greenish, with femora

often feebly annulate. Immatures light green.) In deciduous trees and shrubbery. Humid eastern and the more humid spots in the mountains of west Texas.....11. *Diapheromera femorata* (Say)

11. Male with disto-dorsal margin of poculum less produced in a narrow flange which is not bilobate. Female with cercus averaging longer and femoral apices immaculate (in typical material). Size variable but averaging smaller. Low herbage of plains. Northern portions and Pan-Handle, south in central portion to south-central Texas, elsewhere not typical.[28].....7. *Diapheromera velii velii* Walsh

Male with disto-dorsal portion of poculum strongly bilobate produced. Female with cercus averaging much shorter and femoral apices briefly but strikingly suffused with black. Size variable but averaging larger. (Rare dark gray females sometimes mottled with whitish.) In ground herbage and Mesquite. Southernmost central, south and southwest Texas.....8. *Diapheromera velii eucnemis* Hebard

12. Head less globose and slightly more elongate; two small occipital horns absent in male, present in female. Male with ninth tergite longer than wide. Size averaging smaller and form less robust. Color rarely uniform throughout (male generally very similar in size, color, and form to *velii eucnemis,* often slightly more slender, ninth tergite longer and poculum very distinctive though similarly bilobate at apex. Female generally brown or gray, femora slightly suffused with blackish at bases and sometimes irregularly annulate). In low vegetation and Mesquite. Eastern part of central-northern to south Texas.
9. *Diapheromera tamaulipensis* (Rehn)

Head globose, approximately as wide as long; two small occipital horns present in male, larger in female. Male with ninth tergite as long as wide. Size large and form heavier than any other known species of the genus. Color of male uniform light brown, of female uniform gray. (Immatures dull greenish or brown with intersections of segments darkened like twigs of Creosote Bush to which the species is peculiar.) More arid west Texas.
10. *Diapheromera covilleae* Rehn and Hebard

PHASMIDAE

Anisomorphinae

Anisomorpha ferruginea (Beauvois) (Pl. XIII, figs. 9, 10.)

1805. *Phasma ferruginea* Beauvois, Ins. Rec. Afr. Amer., p. 167, Orth., pl. XIV, figs. 6 and 7. [♂, ♀; Virginia, and South Carolina.]

1920. *Anisomorpha ferruginea* Blatchley, Orth. of Northeastern Amer., p. 146, fig. 57 (♀). (Description, data and known range.)

[28] In the sections of north-central Texas toward the Pecos Valley and in the Rio Grande Valley at El Paso, different atypic conditions of *velii* are present.

Sabine, VIII, 11, 1915, (M. Hebard; in heavy bunch of grass on marshy flats, only one seen), 1 ♀. Virginia Point, VII, 21, 1912, (Rehn and Hebard; on salt marsh in grass two feet high, two only seen), 1 ♂, 1 ♀.

These constitute the first definite records for Texas, the second being a southwestern limit. Material from Texas, collected by J. Boll, was tentatively determined as *A. buprestoides* (Stoll) by Scudder in 1876.

The specimens are decidedly larger and more elongate than those from the northern and mountainous sections of the distribution of *ferruginea,* but average smaller with longitudinal stripes much less striking (weak to obsolete) and head shorter than in *buprestoides.*

Study of our entire series proves that, contrary to past opinion, *buprestoides* is confined to peninsular Florida and extreme southeastern Georgia, *ferruginea* occurring south as far as Sandfly,[29] Albany [29] and Thomasville,[29] Georgia, and Carrabelle, Florida, and present on the Gulf Coast from there to Virginia Point, Texas. Its nothern limits are Virginia; Jackson and Posey Counties, Indiana; Union County, Illinois,[30] and Sawyer, Oklahoma; while the two latter and Virginia Point, Texas are western limits.

So closely related are *ferruginea* and *buprestoides* that the latter may well prove to represent no more than an optimum geographic race.

Pachymorphinae

Parabacillus coloradus (Scudder) (Pl. XIII, figs. 11, 12.)

1903. *B[acillus] coloradus* Scudder, Psyche, VI, p. 372. [♀; [plains of eastern] Colorado, at 5500 feet.]

1934. *Parabacillus coloradus* Hebard, Trans. Amer. Ent. Soc., LX, p. 285 and 290, pl. XX, figs. 7 to 9. (Key, full distributional data and records.)

I reported this species from the following localities in Texas in 1934: Canadian, Dalhart, Lubbock, Sanderson, Marathon, Garden Spring in Brewster County, Moss Well in the Chisos Mountains, Canyon behind Pulliam Bluff in the Chisos Mountains,

[29] Material from this locality as well as similar specimens from Yemassee, South Carolina, was recorded by Rehn and Hebard as *buprestoides* in 1905 and 1916.

[30] Bruner's record of *ferruginea* from southeastern Nebraska is questionable. No material from there has been preserved.

Marfa, western foothills of the Ord Mountains, Pine Mountain in the Davis Mountains, Livermore Peak in the Davis Mountains at 8200 feet and the Franklin Mountains.

Palo Duro Canyon, VIII, 14, 1934, (F. B. Isely), 1 juv. ♀. Fort Davis, 5000 feet, X, 15–27, 1927, (O. C. Poling), 3 ♂.*

In Texas the species is confined to the western portion, Canadian and Sanderson being eastern limits.

HETERONEMIINAE

Pseudosermyle straminea (Scudder)

1902. *Bacunculus stramineus* Scudder, Proc. Davenport Acad. Nat. Sci., IX, p. 20, pl. I, fig. 1. [[Juv.] ♂, juv. ♀; between Mesilla and Little Mountain, New Mexico.]

1929. *Pseudosermyle straminea* Hebard, Proc. Acad. Nat. Sci. Phila., LXXXI, p. 318. (Synonymy and distribution.)

Both *truncata* Caudell 1903 and *tenuis* Rehn and Hebard 1909 were referred to the present synonymy by the author in 1929, who added *arbuscula* Rehn 1902 in 1932.

This species has been recorded in Texas only from the Franklin Mountains near El Paso at 4500 feet by Rehn and Hebard as the synonym *tenuis*.

One hundred and fifty-eight ♂, 24 ♀, taken VIII, 9 to XI, 27, and 48 immature individuals are from Weatherford (on grasses and low plants growing in open on limestone outcrop, much work to secure five adults), Albany (dry grassy plain with scattered dwarf Mesquite),* Cisco (in grasses on stream bank), Benavides, Sarita, Laguna del Gato in Hidalgo County (in grasses at foot of low bushes on gravelly hill), Lubbock (beaten from low rabbit-weed and short grass on plains), Happy Crossing in Palo Duro Canyon in Randall County (beaten from grasses at upper levels, 3500 feet), Sanderson (fairly common in low grasses and plants in dry stream bed and on hill slopes), Del Rio (in small tufts of dry slender grass, one adult female in bush), Sanderson (fairly common in low grasses and plants in dry stream bed and on hill slopes), Marathon (very abundant in rabbit-weed and grasses on plain), two miles north of Bone Spring in Brewster County, Neville Spring in Brewster County, Glenn Spring in Chisos Mountains (in Black Willow),* Canyon behind Pulliam Bluff in Chisos Mountains (in low vegetation on hillside in Oak Zone at 4900

feet), Juniper Canyon in Chisos Mountains (in dead leaves in dry creek-bed through scrub-oak forest),* Lost Mine Peak in Chisos Mountains (very scarce in rabbit-weed at 5800 feet), western foothills of Ord Mountains, Fort Davis,* Phantom Lake in Davis Mountains,* Kent (from low tufts of green grass), Van Horn (beaten from brush) and Sierra Blanca.

The principal reason why so many more males than females are taken is that the latter are not only more sedentary but, at least during the day, are to be found more frequently in bushes the twigs of which they closely resemble, whereas the active males prefer grasses and various species of rabbit-weed. Another reason is that adults of the species, particularly females, appear in greatest numbers late in the season and Rehn and Hebard, who secured all but seven of the specimens here recorded, collected in Texas mainly in August and September.

All but three of the following limital records are based on material secured by Rehn and Hebard, those three from material in the author's collection. The species occurs east to Sarita, Benavides, Weatherford and Palo Duro Canyon, Texas, Harmon County and Kenton, Oklahoma, and La Junta, Colorado. It is found north to the last five localities; Tesuque, New Mexico; Tintic and the Wah Wah Range, Utah; near White Blotch Springs in Lincoln County, Beatty and the south shore of Walker Lake, Nevada. It is known west to the latter; Independence, Riverside and Boulevard, California.

Though undoubtedly present from the Atlantic to the Pacific in northern Mexico, *straminea* has not yet been taken in that country.

Pseudosermyle strigata (Scudder)

1900. *Sermyle strigata* Scudder, Proc. Davenport Acad. Nat. Sci., VIII, p. 94, pl. I, fig. 3. [♀, [eastern] Texas.]

1903. *Bacunculus banksii* Caudell, Proc. U. S. Nat. Mus., XXVI, p. 871. [♂; Buna and Brazos County (selected type locality), Texas.]

The possibility that *banksii* represented merely the male sex of *strigata* was originally noted by Caudell. In all of the species of the present genus the males are very much more slender than the females and highly dissimilar in general appearance. The male recorded with a query as *Bacunculus striatus* (Burmeister) by Brunner from Dallas, Texas, in 1907, certainly represents the present species if it came from that locality.

Five ♂, 2 ♀, taken VII, 24 to X, 31, and 48 immature individuals are from Elkhart (in very fine tall grass on border of forest), Doucette (scarce in undergrowth of pine forest), Beaumont, Navasota (beaten from tall grasses on Post Oak covered hilltop), Houston (in low grasses in pine forest), Harrisburg (in grasses on edge of Short-leaf Pine forest), La Marque (on prairie in grasses and herbage), Dallas (on prairie), Hearne (in grasses near Post Oak thicket), College Station, Flatonia (seventeen immatures taken after much beating of bunch-grass near Post Oak thicket), Victoria (fourteen immatures from short heavy dry grass), Beeville (in grasses) and Mission.

This material was all secured by Rehn and Hebard except three specimens from College Station. Specimens are also before me from Flomaton, Springhill and St. Elmo in Mobile County, Alabama; Strickton, Hattiesburg, Brookhaven and Natchez, Mississippi; Polk County, Arkansas, and Breckenridge, Arcadia, Alexandria, Natchitoches Parish and Lake Charles, Louisiana.

The distribution of the species, belonging to a southwestern and Mexican genus, most of the species of which prefer a semi-arid environment, is thus seen to include not only all of eastern Texas but to extend much further into the lower Mississippi Valley region than was expected.[31]

It is found adult in greatest numbers late in the season, but rare adults are present toward the end of July.

Sermyle mexicana (Saussure) (Pl. XII, fig. 6.)

1859. *A[canthoderus] mexicanus* Saussure, Rev. et Mag. de Zool., XI, p. 62. [[Juv.], Mexico.]

1872. *Ceroys mexicanus* Saussure, Miss. Sci. Mex., Rech. Zool., VI, p. 167, pl. 4, figs. 17 and 17a. [♀ and juv. ♂; Eastern Cordillera of Mexico.]

1904. *Hoplolibethra tuberculata* Caudell, Mus. Brooklyn Inst. Arts and Sci., Sci. Bull. I, p. 108. [♀; Esperanza Ranch near Brownsville, Texas.]

The genotype of *Sermyle* was selected as "*Sermyle mexicanus* Saussure" by Caudell in 1903.[32]

Stål when describing *Sermyle* in 1875 tentatively referred a male from Guatemala to the present species, which male Brunner in 1907 separated and described as his *Bacunculus pratermissus*

[31] The single male which I reported from Tampico, Tamaulipas, in 1932, shows genitalic differences suggesting racial or even specific differentiation.
[32] Proc. U. S. Nat. Mus., XXVI, p. 867, footnote a.

(probably actually a member of the genus *Heteronemia*) and Brunner also found a female from Honduras determined as *Sermyle mexicana* by Stål to represent another species which he described as *Libethra confusa* (extremely close to or a synonym of *Libethra aurita* Rehn, described from Costa Rica in 1905).

A female from Vera Cruz was recorded by Brunner in 1907 but assigned to *Ocnophila,* this specimen noted as from Atoyac by Shelford in 1908. The author published the synonymy indicated above in 1932 and recorded the female here figured from San Rafael, Vera Cruz, collected by C. H. T. Townsend.

Piper Plantation near Brownsville, VIII, 3, 1912, (M. Hebard; beaten from vine tangle in thick growth of Huisache), 1 very small juv.

Definite recognition of the adult male is awaited with interest. This is the most highly specialized species of the Phasmidae which occurs in the United States.

The insect is present in Texas probably only in the thick tangles of shrubbery which are near or choke the now dry river courses known as "resacas" near the mouth of the Rio Grande.

DIAPHEROMERA Gray

Seven of the eleven species and races of this genus found in the United States are present in Texas. After a study of the material now assembled, their relationships are much better understood than has previously been possible.

The genus follows *Manomera* Rehn and Hebard [33] and its first group includes species showing a strong tendency toward that genus, these are *blatchleyi atlantica* (Davis), from the central-eastern States, *blatchleyi blatchleyi* (Caudell) from the upper Mississippi area and *persimilis* Caudell. The next group includes *velii velii* Walsh, *velii eucnemis* Hebard, *tamaulipensis* Rehn and *covilleae* Rehn and Hebard, all found in Texas, the general type of the male poculum is similar in all, *velii* lacks a pair of horns on the head, *tamaulipensis* has these only in the females, while *covilleae* has them in both sexes. The genotype, *femorata* (Say) which also occurs in Texas and the little known *carolina* Scudder

[33] Which includes *tenuescens* (Scudder) and *brachypyga* Rehn and Hebard, from the southeastern United States.

peculiar to the southern Appalachian mountains, form a third group. To the next group belongs *arizonensis* Caudell, found only in Arizona and showing strong affinity to the Mexican *calcarata* (Burmeister). Finally the recently described and very distinctive *torquata* Hebard known only from the Chisos Mountains in southwestern Texas represents an aberrant group other species of which should be sought in Mexico.

Diapheromera persimilis Caudell

1904. *Diapheromera persimilis* Caudell, Mus. Brooklyn Inst. Arts and Sci., Bull., I, p. 107. [♂, ♀; Esperanza Ranch near Brownsville, Texas.]
1907. *B[acunculus] texanus* Brunner, in part, Insektenfam. der Phasmiden, p. 333. [♂, ♀; [probably Dallas], Texas.[34]]
1907. *Diapheromera dolichocephala* Brunner, Insektenfam. der Phasmiden, p. 338. [♂, ♀; Texas.]
1934. *Diapheromera persimilis* Hebard, Bull. Illinois Nat. Hist. Surv., XX, p. 160. (Corrections and comparison with *blatchleyi blatchleyi*.)

Brunner overlooked much of the more or less recent literature in his last monograph and the two synonyms listed above are among the considerable number which resulted.

M. Beier has most kindly examined the original pair of *texanus* from Texas. From his notes I can now state that this material probably came from Dallas, as it was collected by J. Boll in 1875, who did much the greater part of his field work there. In 1931 I selected Texas as the type locality and placed the name as a synonym of *veliei mesillana,* since the description, though miserably inadequate, appeared to best fit that insect. Beier now informs me that the male poculum is simple, without a distal lip; the female has the ultimate tergite 3.0 and the cercus 2.5 mm. in length and that the femora are not darkened distad. These characters fit *persimilis* alone of the Texan walking-sticks, which is indeed the most plentiful species in the vicinity of Dallas and it is evident that *texanus* is a synonym of the present insect instead of the one to which I had referred it.

The species was recorded as *veliei* from Shovel Mount by Rehn in 1903, correctly from Brownsville by Rehn in 1907, from Columbus as *mesillana* by Caudell in 1913 and correctly from Cisco, Kerrville and Uvalde by Hebard in 1931. Material so recorded

[34] As I noted in 1931, the New York specimen was either mislabeled or represents a distinct species.

from El Paso by Rehn and Hebard in 1909, however, is representative of the atypical condition of *velii* which occurs there.

A series of 145 ♂, 107 ♀, taken from VI, 26 to IX, 28 (but in the Brownsville region as late as XI, 30), and 92 immature individuals is from Longview (very scarce in weeds under willows along stream), Doucette (immatures numerous in undergrowth of mixed forest), Jacksonville, Elkhart (adults few, immatures occasional in grass on border of mixed woodland), Navasota (in high grasses among Post Oaks on hilltop), Smith Point, Harrisburg (adults few, immatures abundant in high grasses on border of short-leaf pine forest), La Marque (1 immature only, in grasses and taller plants), Edom, Wills Point (in tall grass and weeds along railroad embankment),* Denison,* Cedar Hill on Day Ranch in Dallas County, Dallas (in oak woods; abundant on prairie, immatures more numerous than adults on VII, 14), Red Oak, Waxahachie, Maypearl, Alvarado, Weatherford (in grasses and low plants on limestone outcrop in open), Albany (on short-grass plains with scattered Mesquite),* Rosenberg, Victoria (moderately numerous in weeds under trees in stream bottom), Port Lavaca, Beeville (1 ♀ in high green grasses), Aransas County, Gregory, Corpus Christi (in grasses and plants near beach), Robstown, Piper Plantation near Brownsville (in vine-covered brush in resaca), Brownsville, Cisco (from bunches of coarse reddish grass on edge of oak woods), Shovel Mount, Blanco County, Kerrville (1 ♂, and a few immatures in ground vegetation), Bandera and Uvalde (2 in tall green-leaved plants, others in ground vegetation).

The species shows a marked decrease in average size northward, but decided size variation is found in all large series and some series average distinctly more slender than others. The body length in the extremes of the material at hand is ♂ 41.3 (Red Oak) to 73.2 (Harrisburg); ♀ 48. (Red Oak) to 99. mm. (Beauregard Parish, Louisiana).

Males with some green on the limbs and without any green on the body are very seldom seen, but there are many more green than buff or brown females. The buff females are sometimes suffused with brown laterad.

A male from Rosenberg and another from Victoria show a remarkable genitalic malformation. In these the seventh tergite is hardly longer than the eighth and shows scarcely any expansion, while the ninth tergite is much more elongate, slightly less than twice as long as broad and the cerci are deflexed, curving cephalad instead of inward, tapering distad to a sharply rounded apex instead of being blunt. In one specimen malformation is apparent, but the other is remarkably symmetrical for so abnormal an individual.[35]

Averaging smaller and more slender than the other Texan members of this genus, this grass-loving species is found throughout the eastern portion of the State. Its range extends East to Cedar Bluffs [36] and Lincoln,[36] Nebraska; Douglas, Crawford and Cherokee Counties, Kansas; Polk County,[36] Arkansas, and Arcadia,[37] Alexandria [37] and Lake Charles,[37] Louisiana: North to Cedar Bluffs, Nebraska; West to Manhattan and Medora, Kansas; Alfalfa County and Chickasha,[36] Oklahoma, and Cisco,[37] Kerrville,[37] Uvalde [37] and Brownsville, Texas.

The species should also be found in the westernmost portion of Missouri [38] and in northeastern Mexico, though it is at yet unknown from those regions.

Diapheromera velii velii Walsh [39]

1864. *Diapheromera velii* Walsh, Proc. Ent. Soc. Phila., III, p. 410. [♂, banks of Platte River, Nebraska; ♀ locality unknown.]

1901. *Diapheromera mesillana* Scudder, Psyche, IX, p. 189. [[Juv.] ♀; between Mesilla and Las Cruces, New Mexico.]

1931. *Diapheromera veliei veliei* Hebard, Ent. News, XLII, p. 66, fig. 1. (Discussion of races and records.)

1934. *Diapheromera velii velii* Hebard, Nat. Hist. Surv. Illinois, Bull., XX, p. 162. (Correction of records.)

This race was recorded from Dallas and (atypical material) the Pecos River by Scudder in 1901; from El Paso by Rehn and Hebard in 1909 as *persimilis* and as *mesillana,* and from Dalhart

[35] See key for normal proportions, page 291.

[36] Material in the author's collection.

[37] Material collected by Rehn and Hebard.

[38] The records of *Manomera blatchleyi blatchleyi* from Missouri and probably those from Iowa are correct and not referable to *persimilis* as I suggested in 1931. This I found to be the case and so published in 1934.

[39] Named for Dr. Velie, it is evident that the author first latinized the name to Velius and that the original spelling, *velii,* must be used.

by Hebard in 1931. A southwestern race was also recognized as *veliei mesillana.* I have now further investigated my entire series of the species and find that, though a recognizable race does exist, the species as found in the valley of the Rio Grande throughout New Mexico, though somewhat atypical, is still representative of *velii velli.* Thus *mesillana* falls as a synonym and I have been obliged to propose for the second race the name *velii eucnemis.*[40]

A series of 24 ♂, 19 ♀, taken VI, 11 to IX, 19, and 4 immatures is from Longview, Dallas, Vernon, Beeville, St. Joseph's Island (very large ♂),* San Antonio, Floresville, Ringgold Barracks, Canadian (beaten from grass on limestone hillsides in heavy cover), Clarendon, Dalhart (generally abundant in grass but particularly so in high grasses), Happy Crossing in Palo Duro Canyon in Randall County at 3200 feet (one male only in rich grass area on canyon bottom), Canyon (in great numbers on purple flowered *Astragalus*), Lubbock (in heavy weeds in depression on plains) and El Paso.

In addition a series of 33 ♂, 32 ♀, taken VI, 16 to IX, 19, and 4 immature specimens is atypical only in averaging very large and in the females having the femora slightly to decidedly darkened at the apices and thus definitely diverging toward *velii eucnemis.* These are from Albany (7 ♂, 8 ♀, 4 immatures from scattered clumps of dwarf mesquite on short-grass plains),* Ballinger (from Mesquite), Big Spring, Midland (in about every other clump of Mesquite, usually from one to three, but once as many as six), Metz, Barstow and Pecos.

The race shows an average decided increase in size from north to south so that the Texan material, and particularly the atypical series listed above, averages very large when compared with material from South Dakota and Nebraska.

As material of other species has been recorded as this species,[41] the distribution of typical *velii velii* is given exclusively from records verified by me or from material now at hand. The race is known East to St. Joseph Island, Beeville, and Floresville, Texas (but east of these points and south of Dallas, Texas considerable extensions of range may be expected); Shreveport, Louisiana;

[40] Trans. Amer. Ent. Soc., LXIII, pp. 350 to 354, pl. XXII, figs. 1 and 2, (1937).

[41] By the author as late as 1931 and 1932. See under *Diapheromera tamaulipensis* Rehn.

Joplin and Memphis, Missouri; Elmira, Central City and Fertile, Iowa, and Lake City, Fort Snelling, Staples and Crookston, Minnesota. Its northern limits are Fort Snelling, Staples and Crookston, Minnesota; Lake Hendricks, Capa and State Game Lodge, South Dakota; Julesburg and Roggen, Colorado, and Santa Cruz, New Mexico. Western limits are Santa Cruz, Corales near Albuquerque and Mesilla, New Mexico, and El Paso and Ringgold Barracks, Texas.

Intergradation with *velii eucnemis* is indicated in all material from Albany, Ballinger and Big Spring westward to the Pecos River in Texas and on the Edwards Plateau either this or typical *velii eucnemis* is probably present. In New Mexico a tendency toward that race is shown also by material from the malpais near Carrizozo and from the White Sands of the Tularosa Valley.

In southwestern Texas and extreme southern New Mexico I believe that *velii velii* is confined to the valley of the Rio Grande, *velii eucnemis* being present elsewhere in that territory. Few previous Mexican records can at present be verified.

Diapheromera velii eucnemis Hebard

1918. *Diapheromera veliei* Caudell (in part not *velii velii*), Ent. News, XXIX, p. 259. [♂, ♀; San Diego and forty miles south of Alice, Texas.]

1931. *Diapheromera veliei mesillana* Hebard, in part, Ent. News, XLII, p. 65, fig. 2. [♂, ♀; Robstown and foothills of Ord Mountains, Texas; Deming, New Mexico.]

1937. *Diapheromera velii eucnemis* Hebard, Trans. Amer. Ent. Soc., LXIII, p. 350, pl. XXII, figs. 1 and 2. [♂, ♀; Marathon, Texas. (The localities given below also given.)]

From the evidence available in 1931 I believed that a distinctive geographic race was present in southern New Mexico and western Texas, for which the name *mesillana* Scudder could be used. Study of much larger series of *velii* later proved that such a geographic race does exist, but that through the Rio Grande valley of New Mexico and western Texas *velii velii* persists and *mesillana,* based on immature material from the locality of that name in the Rio Grande valley, consequently had to be placed as a synonym. I therefore described the race here under consideration as *velii eucnemis* in 1937.

Seventy-two ♂, 38 ♀, taken VI to XI, 5, and 30 immature individuals, in part previously recorded, are from Corpus Christi (in plants and grasses near beach; female cerci longer than typical), Robstown (immatures common in Mesquite), Lyford (1 ♂ in low weeds in field), Premont, Jim Wells County, Brooks County, San Diego, Benavides, Cotulla, Laredo, Sabinal, Uvalde (on hill slopes on low sensitive-leaved mimosa), Carrizo Springs, Del Rio, Marathon (very local but common in high grasses in damp spot), Hackberry Creek in Brewster County, Garden Spring, two miles north of Bone Spring, Neville Spring, Juniper Canyon and Glenn Spring in Chisos Mountains,* Chisos Mountains, foothills of Ord Mountains, mesa fifteen miles north of Presidio, Presidio, Valentine, Van Horn and Sierra Blanca (in low hills at 4700 feet, in green yellow-flowered bush).

This race is known north to Corpus Christi, Cotulla, Sabinal, Del Rio, Marathon, Valentine, Van Horn and Sierra Blanca, Texas, and Deming, New Mexico, which with Denton Well in the Playa Valley are western limits in that State. In Mexico it is known only from Sabinas Hidalgo, Nuevo Leon, where an optimum condition occurs.

The intrusion of *velii velii* along the Rio Grande through a region where *velii eucnemis* is elsewhere generally present constitutes an unusual situation.

The present race may occur typical well north of its known northern limits in western Texas.

Diapheromera femorata (Say)

1824. *S[pectrum] femoratum* Say, in Long, IInd Exped., II, p. 297. [♂: Falls of Niagara; Missouri River.]

1920. *Diapheromera femorata* Blatchley, Orth. of Northeastern Amer., p. 133, figs. 54a and b and 55.

Established synonyms are *Diapheromera sayi* Gray and *Bacunculus laevissimus* Brunner.

Part of the following material was first reported by me in 1931. Dallas, (J. Boll), 3 ♂, 1 ♀, Moss Well in Chisos Mountains, 4500 to 5000 feet, IX, 5 to 8, 1922, (Rehn and Hebard; on grassy hillsides dotted with oaks), 1 ♂, 1 ♀. Juniper Canyon in the Chisos Mountains, VII, 8 to .25, 1928, (F. M. Gaige; from oak-manzanita forest and on dead leaves in dry creek-bed through pine-oak forest), 4 ♂, 2 ♀.* Canyon behind Pulliam Bluff in

Chisos Mountains, 4600 to 5000 feet, IX, 7, 1922, (Rehn and Hebard; rich cover of high grass, many oaks, Sotol, cacti, etc.), 2 juv. ♀. Lost Mine Peak in Chisos Mountains, 5000 to 7500 feet, IX, 6, 1922, (Rehn and Hebard; steep slopes with similar vegetation), 1 ♂, 1 juv. ♀. Foothills of Ord Mountains, (O. C. Poling), VIII, 1 to 15, 1925, 1 ♂; 1928, 1 ♀. Fort Davis, VIII, 15, 1914, (Crystal Thompson; orchard, Tibbet's Ranch), 1 large ♀;* X, 15 to 17, 1927, (O. C. Poling), 2 very small ♂.*

This species, genotype of *Diapheromera,* has been found north to South Bridgeton, Maine; Manchester, New Hampshire; Sudbury, Vermont; central Ontario; Iosco County * and Crawford County,* Michigan; Staples and Park Rapids,[42] Minnesota; Selkirk, Manitoba; and Grand Forks, North Dakota; west to the two latter localities and in continuous distribution as far as Canton, South Dakota; eastern Nebraska; Doniphan County, Kansas; Page in Le Flore County,* Oklahoma; and Dallas, Texas; south to Columbia, South Carolina; Gainesville * and Monticello,* Florida; Greenville,[42] Alabama; Meridian [42] and Strickton,[42] Mississippi; Natchitoches,* Louisiana; and Dallas, Texas.

In discontinuous distribution it occurs, however, far westward in the southern portions of its range, as shown by the material listed above, in the southwest being probably limited to the forested areas in the mountains. Other such records are Santa Fé (undoubtedly in the nearby mountains), Jemez Hot Springs,[42] Three Rivers [42] Bent,[42] the western base of the Organ Mountains and the Hachita Grande Mountains, New Mexico; Zion Canyon, Utah; and Paradise, Naco, and the Baboquivari Mountains,* Arizona.

I believe that under different climatic conditions this evidently ancient species may have moved south through the Rocky Mountains, spreading to these widely separated localities and that subsequently it has disappeared over the northern portions of that area.

Diapheromera tamaulipensis Rehn

1909. *Diapheromera* (*Ceratites*) *tamaulipensis* Rehn, Ent. News, xx, p. 212, 4 text figs. [♂, ♀; Altamira, Tamaulipas, Mexico.]

Material of this species was incorrectly recorded from Ringgold Barracks as *femorata* by Scudder in 1901, from Pecos as *covilleae* by Rehn and Hebard in 1909, from Victoria as *veliei* by Caudell

[42] Material in the Philadelphia collections.

in 1918, from Cisco and Sweetwater as *velici mesillana* by Hebard in 1931 and likewise by the same author from Tampico, Tamaulipas, and Torreon, Coahuila in 1932. Hebard, however, correctly determined material from Sanderson when comparing immatures of the species with those of *torquata* in 1934.

The relationship of this species, on the one hand to *velii eucnemis* and on the other to *covilleae,* is much closer than has been supposed. In general form close agreement with the former is found though *tamaulipensis* averages slightly more slender, males are best separated by the decidedly more elongate shaft of the poculum which protects the much more elongate clasps, females distinguished by the more elongate head which bears two horns. Immatures are as easily separated from those of *veliei eucnemis* as adults, for in *tamaulipensis* the swollen poculum is always considerably more elongate in males, while horns are weakly to very strongly indicated in females.

From *covilleae* males are best separated by their more slender form and head without horns, females by their more slender form and more elongate head, but immatures do not have the striking dark markings and bars which in *covillcae* make the early stages closely resemble the twigs of the Creosote Bush (*Larrea divaricata*) to which that species is peculiar.

Northward in the range of *tamaulipensis* individuals become gradually more robust with shorter heads, this contrast between material from the northern and southern limits of distribution being very striking. As my material from intermediate points (southern Texas) is approximately intermediate in these features, I do not believe that racial separation is justified.

A series of 12 ♂, 8 ♀, taken VIII, 13 to IX, 21 and 26 immatures is from Victoria, Black Bayou in Victoria County, Cisco (scarce on Mesquite, pair in coitu on terminal twigs), Childress (one male, immatures common in weeds and grass on prairie), Sweetwater, Anhalt, Kerrville (in oak shoots), Dunlay (1 immature in thorny scrub on hilltop), San Antonio, Laguna del Gato in Hidalgo County (gray female, hanging to underside of a lower branch of a very green broad-leaved low bush on gravelly hill), Pearsall, Cotulla (one male on tip of a terminal leaf cluster of a Mesquite), Cactus, Uvalde (on hill slopes on low sensitive-

leaved mimosas), Del Rio (in bush on semi-desert hillside), Langtry, Sanderson (a number of immatures in bushes and green plants on semi-desert hillsides, one male in Black Brush, *Flourensia cernua*).

The range of this species is known to extend East to Tampico, Tamaulipas; Laguna del Gato, Victoria, Anhalt and Cisco, Texas; north to Cisco and Childress; west to Childress, Sweetwater, Pecos and Sanderson, Texas, and Torreon, Coahuila.

Diapheromera covilleae Rehn and Hebard

1909. *Diapheromera* (*Ceratites*) [43] *covilleae* Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1909, p. 126, figs. 5 to 9. [♂, ♀: [44] Franklin Mountains at 4500 feet near El Paso (type locality), Texas; Alamogordo and Dry Canyon near Alamogordo, New Mexico.]

A series of 94 ♂, 44 ♀, taken VII, 9 to IX, 16, and 30 immatures are from twenty miles north of the Chisos Mountains (1 ♂), Sierra Blanca at 4700 to 4900 feet (1 ♂, 3 immatures in Creosote Bush, *Larrea divaricata*), El Paso at 3800 to 4000 feet (3 ♀, 1 immature, same) and Franklin Mountains at 3800 to 5500 feet (91 ♂, 41 ♀, 10 immatures, same).

This very large and striking species occurs only in the Creosote Bush, which is often called Greasewood in the southwest (which name, however, is applied to a very different desert bush in the northwest). Near El Paso on September 15, 1912, Rehn and Hebard found it generally present on that shrub, but most plentiful at from 4200 to 4500 feet, where every other Creosote Bush, there rather scattered among a great variety of semi-desert vegetation, would disclose from one to three individuals, whereas on the flat mesa in solid stands of Creosote Bush it was by no means plentiful.

Individuals rest during the day on the underside of the branches of the bushes, hanging loosely, facing the bush with fore legs extended together and antennae between these with tips just touching the stem. Immatures, however, prefer the terminal twigs which

[43] Preoccupied and renamed *Rhabdoceratites* by Rehn and Hebard in 1912, but placed as a synonym of *Diapheromera* by Hebard in 1934, *Trans. Amer. Ent. Soc.*, LX, p. 281.

[44] Seven females from Pecos, Texas, representing the more robust northern condition of *tamaulipensis* are here so assigned, but were in 1909 referred to *covilleae* by Rehn and Hebard.

are darkened at the joints and which they remarkably resemble and two or three of these of the greenish phase were found resting on top of the leaf clusters. An immature when removed and placed a few feet away from its bush first climbed nervously about, up grass stems and over rocks. For a few seconds erratic, it then made for the bush, climbed up until a terminal leaf cluster was reached and then assumed the attitude described above.

I am satisfied that the walking-sticks, at least those found in the United States, should all be classified as nocturnal. In my experience they normally conceal themselves and remain motionless during the day unless disturbed, but at night feed or are met moving actively about.

The extremes in body length of the very large series from near El Paso are; ♂ 70.3 to 88.8, ♀ 89.4 to 102.3 mm., but a female from that locality taken October 16, 1900 is only 76 mm. in length.

The distribution of *covilleae* is not nearly as extensive as that of the Creosote Bush to which it is peculiar. It is found east to twenty miles north of the Chisos Mountains, Texas and Carlsbad,[45] New Mexico: North to Carlsbad, Alamogordo and the Hachita Grande Mountains,[45] New Mexico, and Tucson, six miles north of Ajo [45] and Kingman,[45] Arizona, while the latter and the Growler Valley,[45] Arizona are western limits. It, however, probably occurs throughout central Arizona wherever the Creosote Bush is present. In Mexico it is as yet known only from Jaral and the Sierra del Tlahualilo * [46] (about 70 miles north of Torreon), Coahuila, though probably widely distributed over an extensive north-central area.

Diapheromera torquata Hebard

1934. *Diapheromera torquata* Hebard, Trans. Amer. Ent. Soc., LX, p. 281, pl. XX, figs. 1 to 3. [♀, juv. ♀; Canyon behind Pulliam Bluff and Lost Mine Peak (type locality) in the Chisos Mountains, Texas.]

A series of 5 ♂, 3 immature ♂ and 2 immature ♀ was taken IX, 6, and 7, 1912, by Rehn and Hebard in the rich vegetation of the canyon floor and adjacent steep mountain slopes, in high grass, weeds, much oak brush, low acacias and a profusion of other plants in the Oak Zone.

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[45] Material collected by Rehn and Hebard.

[46] One last instar ♂ immature, 1 small ♀ immature, summer 1935, (W. I. Robinson).

The species is a member of a Mexican group, its nearest known relative being the very distinct *D. erythropleura* Hebard, from Sinaloa. In both of these species the male cerci are unarmed proximad, but their pocula are very differently specialized.

Megaphasma denticrus (Stål)

1875. *Diapheromera denticrus* Stål, Recensio Orth., III, p. 76. [♀; Opelousas, Louisiana.]

1903. *Megaphasma denticrus* Caudell, Proc. U. S. Nat. Mus., XXVI, p. 878, pl. LVII, figs. 2, 2a and 2b. [Description of genus and of male.]

This species was recorded from the Gulf Coast of Texas and New Braunfels by Scudder in 1901; from Helotes and Shovel Mount by Rehn that year and from Shovel Mount in 1902; from Victoria (from weeds on roadside) by Caudell in 1903, and from the Ozark Region, Fort Dodge, Hamburg and Clarinda, Iowa, by Somes in 1916.[47]

Shovel Mount, IX, 30, 1903, (F. G. Schaupp), 2 ♂, (pronotum and mesonotum, except in caudal portions, with a broad longitudinal dorsal band of dull red-brown), [A.N.S.P. and Hebard Cln.]. Victoria, VII, 13, 1907, (J. D. Mitchell; on Post Oak), 1 ♂, (same areas dull greenish brown), [Hebard Cln.]. Black Bayou, V, 19, 1907, (E. B. Williamson), 1 ♂, (same areas dull green), [Hebard Cln.]. Bandera, VII, 7, 1936, (H. R. Roberts), 1 ♂. Chisos Mountains, VII, 22, (J. W. Green), 1 ♂, 1 ♀, (♂ with same areas light red-brown), [Hebard Cln.]; VII and VIII, 1911, (H. A. Wenzel), 2 ♂, 1 ♀, [A.N.S.P. and Hebard Cln.].

A female from "Texas" has the femora irregularly annulate and the tibiae spotted with whitish; a male with the same data, taken June 27 by Belfrage,* has the pronotal and mesonotal areas yellowish green.

The individual size variation is exceedingly great, the body length in the specimens before me showing the following extremes: ♂ 76.3 (Shovel Mount) to 124.6 (Gulf Coast of Texas), ♀ 100 (Shovel Mount) to 150 (Helotes) mm. This species reaches a

[47] Scudder's record from Las Cruces, New Mexico, was probably based on material of *Diapheromera covilleae* and Brunner's 1907 record from Jalapa (not Ilapa), [Vera Cruz], Mexico, was almost surely also based on a misidentification.

much greater size than any of the other walking-sticks which occur in the United States.

The species has been reported as not uncommon in grape vines in wooded bottoms in the vicinity of Victoria.[48]

Recently received data proves that this species has a very much more extensive distribution northward, and particularly northeastward, than is shown by the records hitherto published. It is found east to Opelousas, Louisiana; Elbow Creek in Taney County; * and Joplin, Missouri, and State Forest * [49] and Henryville * [49] in Clark County, Indiana. Northern limits are the latter; Ottawa,[50] Illinois; Fort Dodge, Iowa; Garnett, Kansas,[51] and Shovel Mount and the Chisos Mountains, Texas. Western limits are Fort Dodge and the Des Moines River in Boone County,* [52] Iowa; Garnett, Kansas; Latimer County,[53] Oklahoma; and again, Shovel Mount and the Chisos Mountains, Texas.

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[48] Though intensive search for hours was made in such environment on the afternoon of July 27, 1912 near Victoria by Rehn and Hebard, not a single individual was seen. Search at night with the aid of a light would probably be much more likely to bring success.

[49] Material in University of Michigan and Purdue University Collections.

[50] A record submitted to me through the kindness of J. C. Bradley and F. G. Werner.

One ♂, body length 100 mm., VIII, 1938, (F. G. Werner), [Mus. Comp. Zool.]. Starved Rock State Park, 10 miles west of Ottawa, (D. T. Ries), 1 ♂, [same Park Cln.].

[51] R. H. Beamer writes that this is the only locality for the species known for Kansas, but that in 1940 a heavy infestation was located there in a small wood in September and that several hundred specimens were secured of which the great majority were males, less than a dozen females being taken.

[52] Male examined by me, belonging to Iowa Wesleyan College.

[53] Three males in Hebard Collection.

Explanation of Figures

Plate XII

Fig. 1.—*Labidura riparia* (Pallas). Bidens Variant (optimum). Male. Point Isabel, Texas. × 1½.

Fig. 2.—*Labidura riparia* (Pallas). Bidens Variant. Male. Brownsville, Texas. × 1½.

Fig. 3.—*Arenivaga bolliana* (Saussure). Melanistic Phase. Male. Brownsville, Texas. × 1½.

Fig. 4.—*Arenivaga bolliana* (Saussure). Male. Shovel Mount, Texas. × 1½.

Fig. 5.—*Arenivaga bolliana* (Saussure). Female. Carrizo Springs, Texas. × 1½.

Fig. 6.—*Sermyle mexicana* (Saussure). Female. San Rafael, Vera Cruz, Mexico. Slightly over × ⅔.

Plate XIII

Fig. 7.—*Stagmomantis limbata* (Hahn). Male. Foothills of Ord Mountains, Texas. × ⅘.

Fig. 8.—*Stagmomantis limbata* (Hahn). Female. Foothills of Ord Mountains, Texas. × ⅘.

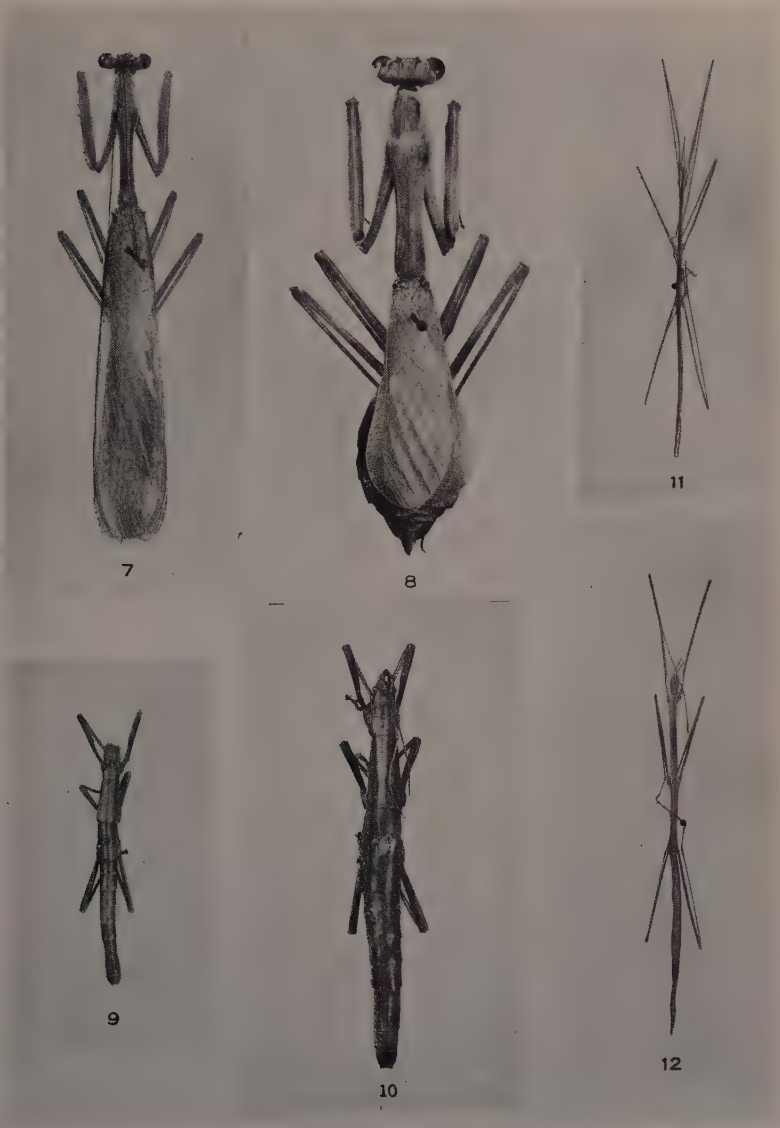
Fig. 9.—*Anisomorpha ferruginea* (Beauvois). Male. Virginia Point, Texas. × ¾.

Fig. 10.—*Anisomorpha ferruginea* (Beauvois). Female. Virginia Point, Texas. Approximately × ¾.

Fig. 11.—*Parabacillus coloradus* (Scudder). Female. Chisos Mountains, Texas. Approximately × ¾.

Fig. 12.—*Parabacillus coloradus* (Scudder). Female. Chisos Mountains, Texas. Approximately × ⅔.

HEBARD—DERMAPTERA AND ORTHOPTERA OF TEXAS



HEBARD—DERMAPTERA AND ORTHOPTERA OF TEXAS

INDEX

New names are followed by the name of the author within parentheses ( ). An asterisk * denotes that a figure is referred to on that page.

abdominalis, Allotrichoma, Hecamede 109
abortiva, Euthlastoblatta, Anoplecta 260
Acanthoderus (*see* mexicana)
aciculata, Plagiopsis, Psilopa ... 127
Acridium (*see* differentialis)
aculeatum, Doru 250
adfinis, Trimerinoides, Trimerina 123
adjunta, Ceropsilopa 128
aeneo-nigra, Psilopa 125
agens, Polytrichophora 114
Aglaopteryx (*see* gemma)
albicans, Hecamede, Notiphila .. 107
alemeidai, Alouattamyia 28
alkalinella, Atissiella (Cresson) .. 112
Allotrichoma (*see* abdominalsi, atrilabris, lateralis, litoralis, simplex, slossonae, yosemite)
Alouattamyia 27
(*See also* alemeidai, baeri, ornata, schroederi)
amedeensis, Eleodes 134
americana, Clanoneurum 128
americana, Kakerlac 263
americana, Periplaneta, Blatta .. 269
amnosus, Blapstinus 136
angusticollis, Elysiacris, Tropinotus 93*
Anisolabis (*see* maritima)
Anisomorpha (*see* buprestoides, ferruginea)
annulipes, Euborellia, Forficesila 246
Anoplecta (*see* abortiva)
Aphanotus 144
(*See also* brevicornis, destructor, parallelus)
apicalis, Eucalyptra 9
apicedentatus, Spongovostox, Spongophora 248
aporus, Pycnosceloides 272
arachidis, Prolabia, Forficula ... 249
arcuata, Eleodes, Litheleodes ... 138
Arenivaga (*see* bolliana, erratica, grata, nigricans, tonkawa)
argyrostoma, Ditrichophora, Gymnoclasiopa, Discocerina 121
arizonensis, Diapheromera 299
arizonensis, Eleodes, Litheleodes 139
atlantica, Diapheromera 298
armata, Eleodes 134
Asilus (*see* atrimaculatus)
aspera, Eleodes, Litheleodes 140
Athyroglossa (*see* glabra, glaphyropus, laevis, melanderi, ordinata)
Atissa (*see* atlantica, humilis, litoralis)
Atissiella (*see* alkalinella, falsisetae, mabelae, pleuriseta)
atlantica, Atissa 110
atrata, Ditrichophora 118
atrilabris, Allotrichoma 108
atrimaculatus, Lecania, Asilus .. 21
atrimana, Leptopsilopa, Psilopa . 126
Atta (*see* fervens)
Attaphila (*see* fungicola)
aurea, Nusina 15
aurifacies, Promachus 21
aurita, Libethra 298
australasiae, Periplaneta 270
azteca, Holocompsa 252
aztecus, Xyronotus 34

Bacillus (*see* coloradus)
Bactromantis (*see* virga)
Bacunculus (*see* banksii, laevissimus, pratermissus, staminea, strigata, texanus)
baeri, Alouattamyia, Cuterebra. 28
banksii, Bacunculus. 296
Basila (Cresson). 116
Batrachopus. 54
(*See also* bicarinatus, cinerascens, obesa)
Baucuterebra. 28
bergi, Tristira. 53
bergii, Eremopachys. 52
bicarinatus, Tropidostethus, Batrachopus. 96*
bidens, Labidura. 247
bidentata, Gymnopa. 106
bipuncta, Gabara, Eucalyptra. . 6
Blaps (*see* extricata)
Blapstinus (*see* amnosus, castaneus, coronadensis, histricus, vandykei)
blatchleyi, Diapheromera. 298
blatchleyi, Manomera. 301
Blatta (*see* americana, germanica, orientalis, supellectilium, surinamensis)
Blatella (*see* germanica)
bolliana, Arenivaga, Homoeogamia. 273*
bolliana, Parcoblatta, Ischnoptera. 263
borealis, Brunneria. 287
brachypyga, Diapheromera. 298
Brachystola (*see* mexicana)
brevicornis, Aphanotus, Eulabis. 145
bruchii, Bufonacris. 48
brunnea, Periplaneta. 270
brunneipennis, Vostox, Psalidophora. 248
brunneonitens, Discocerina, Lamproclasiopa. 116
Brunneria (*see* borealis)
buccata, Hydrochasma, Hecamedoides. 113
buckelli, Psoloessa. 213*
buddiana, Psoloessa. 199
bufo, Moluchacris (Rehn). 58*
Bufonacris. 43
(*See also* bruchii, terrestris, walkeri)
buprestoides, Anisomorpha. 294
bureni, Montemyia (Dalmat). . . 25*
burgessi, Labia. 249

calcarata, Diapheromera. 299
californica, Stagmomantis. 285
Callimantis (*see* floridana)
Campylacantha (*see* olivacea)
cana, Ditrichophora, Gymnoclasiopa. 121
canifrons, Ditrichophora, Gymnoclasiopa. 121
capax, Hydrochasma. 113
carolina, Stagmomantis, Gryllus 283
castaneus, Blapstinus. 136
Catreolus. 90
Catreus. 90
caudelli, Parcoblatta. 266
Ceratites (*see* covilleae, tamaulipennis)
Ceropsilopa (*see* adjunta, coquilletti, dispar, mellipes, nasuta, staffordi)
Ceroys (*see* mexicana)
chlorophaea, Phyllovates, Mantis, Theoclytes. 288
Chorisoneura (*see* texensis)
cilipes, Microstylum. 15
Cilla. 3
(*See also* depunctata, distema)
cincta, Thyrsocera. 269
cinerascens, Moluchacris, Batrachopus. 62*
Clanoneurum (*see* americana)
clarazianus, Papipappus. 50*
Clasiopa (*see* glaucella)
clavigerus, Damalis (Bromley). . 13
Closteridea. 34
cognata, Eleodes, Litheleodes. . . 140

coloradensis, Psoloessa..... 207
coloradus, Parabacillus, Bacillus 294*
Compsodes (*see* schwarzi)
compta, Psilopa, Notiphila..... 124
conciliata, Polytrichophora..... 114
confusa, Liberthra..... 298
consobrina, Ischnoptera..... 262
convexicollis, Eleodes, Litheleodes..... 139
coquilletti, Ceropsilopa..... 127
coronadensis, Blapstinus..... 136
corvina, Eleodes, Litheleodes... 143
couloniana, Ischnoptera..... 267
covilleae, Diapheromera, Ceratites..... 307
cressoni, Leptogaster (Bromley) 13
Crites (Rehn)..... 79
(*See also* prestoni)
cubensis, Panchlora..... 272
cuniculi, Cuterebra..... 28
Cuterebra (*see* baeri, cuniculi)
Cuterebrini..... 26
Cyrtacanthacris (*see* diversifera)

Damalis (*see* clavigerus)
Dasypogon (*see* gigas)
decussata, Stirapleura, Psoloessa 169
delicatula, Psoloessa..... 207*
denticrus, Megaphasma, Diapheromera..... 309
depressa, Lilaea..... 46
depunctata, Cilla..... 8
deropeltiformis, Ischnoptera, Temnopteryx..... 262
desertae, Parcoblatta, Ischnoptera..... 263
destructor, Aphanotus, Tribolium..... 146
Diapheromera..... 298
(*See also* arizonensis, atlantica, blatchleyi, brachypyga, calcarata, covilleae, denticrus, dolichocephala, erythropleura, eucnemis, femorata, mesillana, persimilis, sayi, tamaulipennis, tenuescens, torquata, veliei, velii)
Diclasiopa (*see* lacteipennis)
differentialis, Melanoplus, Acridium..... 154*, 159
dimidiata, Stagmomantis..... 283
Discocerina..... 114
(*See also* argyrostoma, brunneonitens, facialis, flavipes, incisa, lacteipennis, leucoprocta, nadineae, obscura, obscurella, orbitalis, simplex, trochanterata, turgidula)
Discomyza (*see* u-signata)
dispar, Ceropsilopa..... 127
distema, Gabara, Cilla.....8, 10*
Ditrichophora (*see* argyrostoma, atrata, cana, canifrons, exigua, lenis, lugubris, montana, nadineae, occidentalis, parilis, pulchella, simiaceps, subnubila, tacoma, valens)
diversifera, Cyrtacanthacris.... 154
divinatorius, Troctes..... 131
divisa, Parcoblatta, Ischnoptera. 267
Dociostaurus..... 169
(*See also* ornatus)
dolichocephala, Diapheromera.. 299
Doru (*see* aculeatum, lineare)
dupla, Psilopa..... 125

Eleodes (*see* amedeensis, arcuata, arizonensis, armata, aspera, cognata, convexicollis, corvina, extricata, granulata, letcheri, modificata, obtusa, papillosa, parvula, similis, striatipennis, subaspera, tuberculata, utahensis, vandykei)
Elysiacris (Rehn)..... 90
(*See also* angusticollis)
Eremoblatta (*see* subdiaphana)
Eremopachys..... 51
(*See also* bergi, simplex)

erratica, Arenivaga, Homoeogamia 275
erythropleura, Diapheromera ... 309
Euborellia (*see* annulipes)
Eucalyptra 3
(*See also* apicalis, bipuncta, humeralis, minorata, nivealis, strigata, umbonata)
eucnemis, Diapheromera 303
Eulabis (*see* brevicornis)
eurotiae, Psoloessa 207
Euthlastoblatta (*see* abortiva)
exigua, Ditrichophora 118
exilis, Forficula 250
exoleta, Panchlora 272
extricata, Eleodes, Blaps, Litheleodes 139

facialis, Discocerina 115
fallax, Ommatius 18
falsisetae, Atissiella (Cresson) ... 110
fanovana, Ommatius (Bromley) . 16
fanovanensis, Senoprosopis (Bromley) 19*
femorata, Diapheromera, Spectrum 304
ferruginea, Anisomorpha, Phasma 293*
ferruginea, Psoloessa ... 175, 188, 199
fervens, Atta 273
flava, Psilopa 125
flavipes, Discocerina 115
floridana, Callimantis 284
Forficesila (*see* annulipes)
Forficula (*see* arachidis, exilis, lineare, maritima, minor, pulchella, riparia)
fuliginosa, Periplaneta, Kakerlac 270
fulvescens, Parcoblatta, Ischnoptera 265
fulvipennis, Psilopa 125
funebris, Trichochrous 129
fungicola, Attaphila 273

Gabara 3
(*See also* bipuncta, distema, humeralis, pulverosalis, subnivosella)
gemma, Aglaopteryx 261
germanica, Blatella, Blatta 262
gigas, Microstylum, Dasypogon . 15
glabra, Athyroglossa, Notiphila . 106
glaphyropus, Athyroglossa 107
glaucella, Hecamedoides, Clasiopa 117
Gelnanthe (*see* litorea)
gracilicornis, Triorophus 132
granulata, Eleodes, Litheleodes . 140
grata, Arenivaga 274
griseum, Microstylum 15
Gryllus (*see* carolina)
Guerinioestrus 27
guttata, Labia 249
Gymnoclasiopa (*see* Ditrichophora)
Gymnopa (*see* bidentata, tibialis)

Hecamede (*see* abdominalis, albicans, lateralis)
Hecamedoides (*see* buccata, glaucella)
Helaeomyia (*see* nigra, petrolei)
hinei, Plagiopsis, Psilopa 127
Hippiscus (*see* ocelota)
histricus, Blapstinus 136
hobbyi, Promachus (Bromley) .. 20
Holcocephala (*see* lambertoni)
Holocompsa (*see* azteca, nitidula)
Homoeogamia (*see* bolliana, erratica, submoblatta)
Hoplolibethra (*see* tuberculata)
hospes, Symploce 252
humeralis, Gabara, Eucalyptra 9, 10*
humilis, Atissa, Parephydra 110
Hydrochasma (*see* buccata, capax, incisa, leucoprocta)

impiger, Melanoplus 288
Inacris (Rehn) 72
(*See also* phaenogaster)
inaequalis, Ischnoptera 268

incisa, Hydrochasma, Discocerina 113
insigne, Microstylum 15
insolita, Ischnoptera 264
intercepta, Pseudomops 269
Ischnoptera (*see* bolliana, consobrina, couloniana, deropeltiformis, desertae, divisa, fulvescens, inaequalis, insolita, lata, occidentalis, uhleriana)

Kerkerlac (*see* americana, fuliginosa, schaefferi)
kiowa, Mestobregma 208

Labia (*see* burgessi, guttata, minor)
Labidura (*see* bidens, riparia)
lacteipennis, Diclasiopa, Discocerina 117
laevis, Athyroglossa, Ochtheroidea 107
laevissimus, Bacunculus 304
lambertoni, Holocephala (Bromley) 14
lambertoni, Leptogaster (Bromley) 11*
lambertoni, Ommatius (Bromley) 17
Lamproclasiopa (*see* Discocerina)
Laphria (*see* macra, nusoides)
lariversi, Triorophus (Blaisdell) . 132
lata, Parcoblatta, Ischnoptera .. 266
lateralis, Allotrichoma, Hecamede 108
Latindia (*see* schwarzi)
Lecania (*see* atrimaculatus)
lemur, Promachus 21
lenis, Ditrichophora 118
Leptogaster (*see* cressoni, lambertoni, madagascarensis)
Leptopsilopa (*see* atrimana, nigrimana, similis, varipes)
letcheri, Eleodes, Litheleodes ... 143
leucoprocta, Hydrochasma, Discocerina 114
leucostoma, Psilopa, Notiphila .. 124
Leurolestes (*see* pallidus)
Libethra (*see* aurita, confusa)
Lilaea 43
(*See also* depressa)
limbata, Stagmomantis, Mantis 286*
lineare, Doru, Forficula 250
lita, Symploce 252
Litaneutria (*see* minor, skinneri)
Litheleodes (*see* Eleodes)
litoralis, Atissa, Allotrichoma ... 110
litorea, Glenanthe 107
littoralis, Melanoplus (Roberts) 159*
longicornis, Triorophus 131
longiforceps, Ommatius (Bromley) 17*
luciferoides, Microstylum (Bromley) 14
lugubris, Ditrichophora 119

mabelae, Atissiella 111
macquarti, Ommatius 18
macra, Laphria 15
maculipenns, Psoloessa . 175, 188, 199
madagascarensis, Leptogaster (Bromley) 12
madagascarensis, Neomochtherus (Bromley) 19*
madagascarensis, Orthogonis (Bromley) 16*
madagascarensis, Promachus (Bromley) 20
madizans, Trimerina, Notiphila . 124
magellanica, Tristira, Phrynotettix 53
Manomera (*see* blatchleyi)
Mantis (*see* chlorophaea, limbata)
maritima, Anisolabis, Forficula .. 246
marmorata, Scirtetica 208
mescalero, Stirapleura 203
mesillana, Diapheromera 301
Mestobregma (*see* kiowa)
melanderi, Athyroglossa, Ochtheroidea 106

Melanoplus (*see* differentialis, impiger, littoralis, meridae, nigricans, sumichrasti, vicinulus)
mellipes, Ceropsilopa, Psilopa... 127
meridae, Melanoplus (Roberts). 159*
mexicana, Brachystola..... 154
mexicana, Oligonicella, Oligonyx 283
mexicana, Sermyle, Acanthoderus, Ceroys..... 297*
Microstylum (*see* cilipes, gigas, griseum, insigne, luciferoides, tananarivensis)
minor, Labia, Forficula..... 248
minor, Litaneutria, Stagmatoptera..... 280
minorata, Eucalyptra..... 4
modificata, Eleodes, Litheleodes. 141
Moluchacris (Rehn)..... 54
(*See also* bufo, cinerascens, obesa)
montana, Ditrichophora, Gymnoclasiopa (Cresson)..... 120
Montemyia (Dalmat)..... 24
Mosillus (*see* tibialis)

nadineae, Discocerina, Basila, Ditrichophora..... 116
nasuta, Ceropsilopa..... 128
Neomochtherus (*see* madagascarensis)
Neostylopyga (*see* rhombifolia)
nevadensis, Trichochrous (Blaisdell)..... 129
nigra, Helaeomyia, Psilopa..... 124
nigricans, Arenivaga..... 273
nigricans, Melanoplus..... 154*
nigrimana, Leptopsilopa, Psilopa 126
nitidula, Holocompsa..... 252
nivealis, Eucalyptra..... 5
Notiphila (*see* albicans, compta, glabra, leucostoma, madizans, obscurella, plumosa, pulchella)
Nusina (*see* aurea)
nusoides, Laphria..... 15

obesa, Moluchacris, Batrachopus 57
oblongata, Pseudomops..... 269
obscura, Discocerina, Lamproclasiopa..... 115
obscurella, Discocerina, Notiphila..... 115
obtusa, Eleodes, Litheleodes.... 140
occidentalis, Ditrichophora (Cresson)..... 118
occidentalis, Ischnoptera..... 262
ocelota, Hippiscus..... 154
Ochtheroidea (*see* laevis, melanderi)
olga, Psilopa..... 124
Oligonicella (*see* mexicana, scudderi)
Oligonyx (*see* mexicana, scudderi)
olivacea, Campylacantha..... 288
Ommatius (*see* fallax, fanovana, lambertoni, longiforceps, macquarti, pulchripes, terminalis)
orbitalis, Polytrichophora, Discocerina..... 114
ordinata, Parathyroglossa, Athyroglossa..... 106
Oricuterebra..... 28
orientalis, Blatta..... 271
ornata, Alouattamyia..... 28
ornatus, Dociostaurus..... 207
ornaticollis, Tropinotus..... 90
Orthogonis (*see* madagascarensis)

pallidus, Leurolestes..... 252
Panchlora (*see* cubensis, exoleta)
papillosa, Eleodes, Litheleodes.. 144
Papipappus..... 49
(*See also* clarazianus)
Pappacris 50
Pappus..... 50
(*See also* patagonus)
Parabacillus (*see* coloradus)
Paracrites (Rehn)..... 86
(*See also* pichis)
Paracuterebra..... 28
parallelus, Aphanotus..... 146

Parathyroglossa (*see* ordinata)
Parcoblatta (*see* bolliana, caudelli, desertae, divisa, fulvescens, lata, pensylvanica, virginica, zebra)
Parephydra (*see* humilis)
parilis, Ditrichophora, Gymnoclasiopa 119
parvula, Eleodes, Litheleodes ... 141
patagonus, Pappus 33
pawnee, Psoloessa texana (Rehn) 188*, 206
Pelignus (*see* salinus)
pensylvanica, Parcoblatta, Blatta 268
Peplacris (Rehn) 64
(*See also* recuitita)
Periplaneta (*see* americana, australasiae, brunnea, fuliginosa)
persimilis, Diapheromera 299
peruviana, Punacris, Phrynotettix 68*
petrolei, Helaeomyia, Psilopa ... 124
Pezotettix (*see* sumichrasti)
phaenogaster, Inacris (Rehn) ... 74*
Phasma (*see* ferruginea)
Phasmomantis (*see* sumichrasti)
Phrynotettix 68
(*See also* magellanica, peruviana, rana, verruculatus)
Phyllovates (*see* chlorophaea)
pichis, Paracrites (Rehn) 88*
Plagiopsis (*see* aciculata, hinei, skinneri)
pleuriseta, Atissiella (Cresson) .. 111
plumosa, Notiphila 115
Polytrichophora (*see* agens, conciliata, orbitalis, setigera)
pratermissus, Bacunculus 297
prestoni, Crites (Rehn) 82*
Prolabia (*see* arachidis, pulchella, unidentata)
Promachus (*see* aurifacies, hobbyi, lemur, madagascarensis)
Psalidophora (*see* brunneipennis)
Pseudogametini 26
Pseudomops (*see* intercepta, oblongata, septemtrionalis)
Pseudosermyle (*see* staminea, strigata, tenuis, truncata)
Psilopa (*see* aciculata, aeneonigra, atrimana, compta, dupla, flava, fulvipennis, hinei, leucostoma, mellipes, nigra, nigrimana, olga, petrolei, pulchripes, similis, skinneri, varipes)
Psoloessa 169
(*See also* buckelli, buddiana, coloradensis, decussata, delicatula, eurotiae, ferruginea, maculipennis, pawnee, pusilla, texana, thamnogaea)
pulchella, Ditrichophora, Gymnoclasiopa, Notiphila 121
pulchella, Prolabia, Forficula ... 249
pulchripes, Ommatius 18
pulchripes, Psilopa 124
pulverosalis, Gabara, Scopula ..4, 10*
Punacris (Rehn) 68
(*See also* peruviana)
punctum, Stichopogon 14
pusilla, Psoloessa 203*
pusilla, Stirapleura 175
Pycnosceloides (*see* aporus)
Pycnoscelus (*see* surinamensis)

rana, Phrynotettix 68
recuitita, Peplacris (Rehn) 65*
Rhabdoceratites 307
rhombifolia, Neostylopyga 252
Rhysophora (*see* robusta)
riparia, Labidura, Forficula 247*
robusta, Rhysophora 123
Rogenhofera 28

salinus, Pelignus (Cresson) 109
sayi, Diapheromera 304
schaefferi, Kackerlac 263
schroederi, Alouattamyia 28
schwarzi, Compsodes, Latindia .. 272

Scirtetica (*see* marmorata)
scudderi, Oligonicella, Oligonyx. 282
Scyllina..... 169
semiatra, Xylocopodes..... 29
Senoprosopis (*see* fanovanensis)
septemtrionalis, Pseudomops... 268
Sermyla (*see* mexicnan, strigata)
setigera, Polytrichophora..... 114
simiaceps, Ditrichophora..... 117
similis, Eleodes, Litheleodes (Blaisdell)..... 142
similis, Leptopsilopa, Psilopa... 126
simplex, Allotrichoma, Discocerina..... 108
simplex, Eremopachys..... 52
simplex, Stagmomantis..... 283
skinneri, Litaneutria..... 280
skinneri, Plagiopsis, Psilopa.... 126
slossonae, Allotrichoma (Cresson)..... 108
solitarium, Yersiniops, Yersinia. 281
Spectrum (*see* femorata)
Spongophora (*see* apicedentatus)
Spongovostox (*see* apicedentatus)
staffordi, Ceropsilopa..... 127
Stagmatoptera (*see* minor)
Stagmomantis (*see* californica, carolina, dimidiata, limbata, simplex, stollii, tolteca)
staminea, Pseudosermyle, Bacunculus..... 295
Stichopogon (*see* punctum)
Stirapleura..... 169
(*See also* decussata, mescalero, pusilla, tenuicarina)
stollii, Stagmomantis..... 283
striatipennis, Eleodes (Blaisdell) 134
strigata, Eucalyptra..... 8
strigata, Pseudosermyle, Sermyle, Bacunculus..... 296
subaspera, Eleodes..... 140
subcalvus, Trichochrous..... 129
subdiaphana, Eremoblatta, Homoeogamia..... 276
subnivosella, Gabara.....5, 10*
subnubila, Ditrichophora, Gymnoclasiopa..... 120
subvittiger, Trichochrous..... 130
sulcaticollis, Tropinotus..... 90
sumichrasti, Melanoplus, Pezotettix.....156*, 159
sumichrasti, Phasmomantis..... 287
Supella (*see* supellectilium)
supellectilium, Supella, Blatta.. 261
surinamensis, Pycnoscelus, Blatta, Leucophaea..... 271
Symploce (*see* hospes, lita)

tacoma, Ditrichophora, Gymnoclasiopa..... 119
tamaulipensis, Diapheromera, Ceratites..... 305
tananarivensis, Microstylum.... 15
Temnopteryx (*see* deropeltiformis, texensis, virginica)
tenuescens, Diapheromera..... 298
tenuicarina, Stirapleura..... 207
tenuis, Pseudosermyle..... 295
terminalis, Ommatius..... 18
terrestris, Bufonacris..... 46*
texana, Psoloessa.169, 175, 188, 199*
texanus, Bacunculus..... 299
texensis, Chorisoneura..... 260
texensis, Temnopteryx..... 265
thamnogaea, Psoloessa (Rehn).....175*, 197*
Theoclytes (*see* chlorophaea)
Thyrsocera (*see* cincta)
tibialis, Gymnopa, Mosillus.... 106
tolteca, Stagmomantis..... 283
tonkawa, Arenivaga..... 273
torquata, Diapheromera..... 308
Tribolium (*see* destructor)
Trichochrous (*see* funebris, nevadensis, subcalvus, subvittiger, vittiger)
Trimerina (*see* adfinis, madizans)
Trimerinoides (*see* adfinis)
Triorophus (*see* gracilicornis, lariversi, longicornis)

Tristira..... 52
(*See also* bergi, magellanica)
trochanterata, Discocerina..... 115
Troctes (*see* divinatorius)
Tropidostethus..... 95
(*See also* bicarinatus)
Tropinotus..... 90
(*See also* angusticollis, ornaticollis, sulcaticollis)
truncata, Pseudosermyle..... 295
tuberculata, Eleodes..... 144
tuberculata, Hoplolibethra..... 297
turgidula, Discocerina, Lamproclasiopa..... 116

uhleriana, Ischnoptera..... 264
umbonata, Eucalyptra..... 9
u-signata, Discomyza..... 128
unidentata, Prolabia..... 249
utahensis, Eleodes, Litheleodes.. 139

valens, Ditrichophora (Cresson). 118
vandykei, Blapstinus (Blaisdell). 136
vandykei, Eleodes, Litheleodes.. 141
varipes, Peptopsilopa, Psilopa.. 126
veliei, Diapheromera..... 299
velii, Diapheromera..... 301
verruculatus, Phrynotettix..... 33
vicinulus, Melanoplus (Roberts) 158*
virga, Bactromantis..... 283
virginica, Parcoblatta, Temnopteryx..... 265
vittiger, Trichochrous..... 130
Vostox (*see* brunneipennis)

walkeri, Bufonacris..... 43

Xylocopodes..... 27
(*See also* semiatra)
Xyronotus..... 34

Yersinia (*see* solitarium)
Yersiniops (*see* solitarium)
yosemite, Allotrichoma..... 108

zebra, Parcoblatta..... 264

II *
1 P6